

Service Manual

Aitecs 2016

SYRINGE INFUSION PUMP

BS049055EN-P01



Prior to servicing this pump, read this manual and the pump's Operator's Manual carefully to fully understand the pump's functionality and to ensure safe and proper servicing.

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1. INTRODUCTION

1.1. GENERAL INFORMATION

The AITECS 2016 syringe pump is designed to accurately control the delivery of solution to the patient by means of a disposable syringe.

The AITECS 2016 syringe pump is compatible with a wide range of standard, single-use, disposable Luer-lock syringes, ranging from 5 ml to 60 ml in size.

This SERVICE MANUAL describes the theory of operation, how to check, troubleshoot and repair AITECS 2016 syringe infusion pump.

Ensure that you are fully familiar with this equipment by carefully studying the Operator's Manual and this Service Manual prior to attempting any repairs or servicing.

1.2. GENERAL PRECAUTION



Please read the general Operating Precautions described in the Operator's Manual carefully prior to using this syringe pump.



This pump contains static-sensitive components. Observe strict precautions for the protection of static sensitive components when attempting to repair and service the syringe pump.



An explosion hazard exists if the syringe pump is used in the presence of flammable materials. Exercise care to locate the pump away from any such hazardous sources.



An electrical shock hazard exists if the syringe pump casing is opened or removed. Refer all servicing to qualified service personnel.



This syringe pump is protected against the effects of high energy radio frequency emissions and is designed to fail safe if extremely high levels of interference are encountered. Should false alarm condition be encountered, either remove the source of the interference or regulate the infusion by another appropriate means.



If the syringe pump is dropped, subjected to excessive moisture, humidity or high temperature, or otherwise suspected to have been damaged, remove it from service for inspection by qualified service personnel.

1.3. SERVICE CONTACT

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2. TECHNICAL DESCRIPTION

2.1. GENERAL

The Block Diagram of the syringe pump is given in the section 7.1. The Electrical Schematic Diagram is given in the section 7.2. The syringe pump is composed of the following elements:

- Keypad
- Syringe barrel sensor
- Syringe size sensor
- Main Electronic board (MEB)
- Pusher sensors unit
- Motor
- Encoder
- Pressure sensor
- Pusher home sensors
- Drive Unit board
- Switching power supply
- Battery unit
- IrDA unit
- Power supply unit

Below follows a description of these elements, refer the appropriate diagram for full understanding of the functionality:

2.1.1. Keypad

Keypad comprises of a 6 x 4 key matrix connected to the Main Electronic board at connector JP3. ON/OFF key, C key and BATTERY & MAINS LED's are also located on the keypad.

2.1.2. Syringe barrel sensor

The syringe barrel sensor comprises photo interrupter D1. When the syringe is loaded, the shutter is drawn out of the slot of the photo interrupter D1, enabling its optical link. The LED of the photo interrupter is supplied with pulse-modulated current through pin 3 of JP4 connector of the Main Electronic board.

2.1.3. Syringe size sensor

The syringe size sensing is achieved using the linear potentiometer R1. The signal from the potentiometer slider is applied to the Main Electronic board via pin 2 of JP8 connector.

2.1.4. Pusher sensors unit

The plunger push-button sensors are composed of two photo interrupters D1, D2. The grippers latched sensor comprises photo interrupter D3. The LED's of the photo interrupters are supplied with pulse-modulated current through pin 3 of JP8 connector of the Drive Unit board.

When the syringe is loaded, the shutter is outside the slot of D1 is and inside the slot of D2.

When the syringe is loaded, the shutter controlling the photo interrupter D3 is outside of its slot.

2.1.5. Motor

A two-phase bipolar stepper motor with 1.8° step-angle is used in the pump drive. The motor is connected to the Drive Unit board via connector P6 and is driven in micro stepping mode. There are 200 steps to complete one full revolution of the motor shaft. The motor is connected to the lead screw by means of timing belt. The belt ratio is 1.6(6):1; as a result 333.3(3) motor steps move the drive carriage by 1.25 mm.

2.1.6. Encoder

Motor speed and direction is monitored by means of the encoder. It is composed of two photo-interrupters D1, D2 and a 12 slot-encoding disk mounted on the lead screw. Quadrature signals (Tax1, Tax2) are transferred to the Drive Unit board via JP5 connector.

2.1.7. Pressure sensor

As a pressure sensor is used a strain gauge TZ1 mounted on a steel plate. When this plate is deflected by applied force on the plunger, a differential voltage is generated at gauge output. This signal, which magnitude is proportional to the applied force, is transferred to the Drive Unit board.

2.1.8. Pusher home sensor

The pusher home sensors are composed of two photo interrupters D1, D2. When the syringe pusher is in the right end position, the shutter is outside the slot of D1 and inside the slot of D2.

2.1.9. Switching power supply

A 30W single output 12V, 2.5A medical type switching power supply is used in the pump.




2.1.10. Battery unit

The battery unit comprises the Ni-MH (7,2V x 2.5Ah) battery GB1 together with the battery monitoring circuit. The integrated circuit U1 monitors battery voltage, temperature and charge/discharge current. This data is used to calculate battery charge state and remaining working time when pump runs on battery. Data is transferred to the microcontroller via 1-Wire interface (pin 4 of the JP1 connector). R2 is a current sense resistor; R3 and C1 constitute a low pass filter for the current monitoring circuit. Thermistor R1 terminates battery charging if battery temperature exceeds the permissible value. The resettable fuse F1 protects against a short circuit of the battery.

2.1.11. IrDA unit

Serial infrared data communication is operating in accordance with the IrDA standard using modulator-demodulator U1 and transceiver U2. The transceiver is mounted on the rear of the PCB, in front of the window at the back of the pump. The window is covered with dark IR-transparent plastic.

3. SERVICE MENU

While keeping pressed the  key turn the pump on. Enter code **751** using the numerical keypad. Press **OK** to confirm the code. The Service Menu will be displayed. Use the   keys to select the required parameter.

3.1. MAINTENANCE MENU

Select the **MAINTENANCE MENU** from the Service menu and press the **OK** softkey. Use the



keys to select the required parameter. Press the **OK** softkey:

- to set DEFAULT PARAMETERS
- to modify the NEXT SERVICE DATE
- to view the selected LOG (event, use, key or service)
- to set ALARM PITCH
- to set ALERT PITCH
- to view serial number


Press the **BACK** softkey to return to Service menu.



3.2. PROGRAM LOADING

3.2.1. Loading main program

To perform a programming operation, the following is required:

- A2016 Firmware Upload Utility must be installed and configured on the computer that is being used.
- Either USB cable must be connected between the USB port of the computer and the USB connector in the rear of the pump.

While keeping pressed the  key, turn the pump on. The Loader USB message shall appear on the screen. The pump is ready for loading the program.
Programming sequence:

- Start A2016 Firmware Upload Utility application by clicking on the appropriate icon.
- Select USB interface.
- Click on **Firmware**  key in order to load program.
- Click on **Firmware**  key to start the programming operation.

When programming completed switch off the pump using the **ON/OFF** key. Having loaded new program it is necessary to set DEFAULT PARAMETERS and execute full testing (see Section 3.4.1).

3.2.2. Loading Bootstrap

In order to perform a programming operation, the following should be in place:

- A2016 Firmware Upload Utility should be installed and configured on the computer that is being used.

- Having opened the pump housing, Bootstrap Loader Unit should be connected between the Main Electronic board connector JP7 and the COM port of the computer. Bootstrap Loader Unit switch should be in ON position.


Switch on the pump. Press the Reset key on the Bootstrap Loader Unit. The pump is now ready to download a Bootstrap.

Programming sequence:

- Start A2016 Firmware Upload Utility application by clicking on the appropriate icon.

- Select which COM port is going to be used.

- Click on **Bootloader**  key in order to load Bootstrap.

- Click on **Bootloader**  key to start the programming operation.

After Bootstrap downloading process is completed, it is necessary to switch Bootstrap Loader Unit switch into OFF position and to press the Reset key.

Having loaded new bootloader it is necessary to set DEFAULT PARAMETERS and execute full testing (see Section 3.4.1).

3.3. MOTOR PROGRAM LOADING

To perform a programming operation, the following is required:

- A2016 Firmware Upload Utility must be installed and configured on the computer that is being used.

- Either USB cable must be connected between the USB port of the computer and the USB connector in the rear of the pump.


Select the MOTOR PROGRAM LOADING and press the **OK** softkey. The MOTOR PROGRAM UPGRADE message shall appear on the screen. The pump is ready for loading the motor program.

Programming sequence:

- Start A2016 Firmware Upload Utility application by clicking on the appropriate icon.



- Select USB interface.

- Click on **Motor**  key in order to load program.

- Click on **Motor**  key to start the programming operation.

When programming completed switch off the pump using the **ON/OFF** key. Having loaded new program it is necessary to set DEFAULT PARAMETERS and execute full testing (see Section 3.4.1).

3.4. CALIBRATION

Select the **CALIBRATION** from the Service menu and press the **OK** softkey. Select item to be calibrated using the   keys and press the **OK** softkey.

3.4.1. Syringe size calibration

The syringe size detection system stores the characteristics of the syringe clamp assembly, including the travel of the linear potentiometer in non-volatile memory.

Equipment:

- Spacer (gauge) SP0 (B8640027-04);
- Spacer (gauge) SP1 (B8640037-01);
- Spacer (gauge) SP2 (B8640037-02);
- Spacer (gauge) SP3 (B8640037-03).

Select the **Syringe size** from calibration menu and press the **OK** softkey. With the syringe clamp at the lowermost position press the **OK** softkey. One after another insert spacers from 0 to 3, each time closing the syringe clamp and pressing the **OK** softkey to acknowledge. Finally fix the syringe clamp at the uppermost position and again press the **OK** softkey.

3.4.2. Pusher button and pusher position calibration

Equipment:

- Calibration spacer (gauge) SP1 (B8640037-01).

Select the **Pusher button & pusher position** from calibration menu and press the **OK** softkey. Press the pusher lever if appropriate message appears. When display reads the **Insert spacer SP1 and press OK** message, insert the SP1 spacer and press the **OK** softkey. Syringe pusher shall move forward until it comes in contact with the spacer. When syringe pusher stops automatically and display reads a **CONFIRM** softkey, press the **CONFIRM** softkey.

3.4.3. Force (pressure) calibration

Equipment:

- Digitron pressure meter, model: 2022P (0-1500 mmHg);
- 50 ml BD PLASTIPAK or 60 ml BD syringe with extension line.

Screws fastening rear case to front case must be unscrewed.

Select the **Force sensor** from calibration menu and press the **OK** softkey. Then follow directions on the display.

When the **Is pusher free?** message appears, make sure that pushing surface of the retainer is not in contact with any part of pump or extraneous object.

When **Adjust readings...** message appears check the value indicated at left bottom corner of screen and adjust it, if out of above indicated on the screen range, by means of potentiometer R30 on the Drive Unit.

Upon prompt of inserting syringe, fill syringe with 10-20 ml of water, and fit it to the pump.

Connect pressure meter to the syringe by means of the extension line. Locate the pressure meter at the same height as the syringe and press the **OK** softkey.

After the pusher comes in contact with syringe plunger press the **>** softkey and keep it depressed, allowing the transmission to run until the pressure meter reads (120 ± 1.5) cmHg. When approaching the target value, it is recommended to run transmission in short steps, pressing the **>** key momentarily. If you fail to stop movement timely and target value is overridden, calibration procedure must be repeated from the beginning.

When pressure is adjusted as required, press the **OK** softkey.

Press the **BACK** softkey to exit.

NOTE. When calibrating force sensor after repairing or replacing drive or pusher, it is necessary to go through described above procedure three times, first and second time running transmission until pressure goes to 140-150 cmHg, and the last time – exactly as described.

3.4.4. Battery capacity calibration

Battery capacity calibration cycles the battery through a charge, discharge, re-charge sequence during which the fuel gauge within the Battery Unit will be updated with a measurement of the current capacity of the cells.

This calibration allows the fuel gauge to monitor accurately the charge in the pack. Over time the estimate of capacity may drift from the actual cell capacity, which generally decreases with time.

Recalibration will update the fuel gauge with the measured capacity of the cells.



Remove the battery pack lid to ensure a stable pack environment during calibration. It is recommended that the pack is removed from the battery compartment and placed behind the pump. Connect the pump without syringe to the mains.

Select the **Battery Capacity** from calibration menu and press the **OK** softkey. Press **START** softkey in the following window. Leave pump in calibration mode for up to 20 hours. The cycle should run passing automatically three phases one by one:

- Initial charge phase – up to 4 hours
- Measured discharge phase. Pack is discharged using typical load down to 1.1 V per cell to determine how much charge is available from the pack – up to 12 hours
- Final charge phase. Pack is fully recharged ready for use. Early in this phase the measured discharge value is transferred to the pack gas gauge to be stored as the new capacity (mAh).

During the course of calibration the battery related information is displayed on the pump screen. At the end the **CALIBRATION COMPLETED** message appears. Press the **BACK** softkey to exit.

3.5. TESTING

Select the **TESTING** from the Service menu and press the **OK** softkey. Select the item to be tested using the   keys and press the **OK** softkey.

3.5.1. Full testing

This section provides a complete pump test procedure. Follow each stage test and follow the instructions on the display use the **NEXT** softkey to move to the other test.

3.5.2. Program testing

This test is intended to calculate program and bootstrap CRC. Select the **Program** from testing menu and press the **OK** softkey. Software version, bootstrap version and calculated CRC values are indicated in the display. Press the **BACK** softkey to return to TESTING menu.

3.5.3. Drive sensors test

This test enables checking of the following sensors: pusher home, pusher button, grippers unlatch and syringe barrel.

Select **Drive Sensors** from the testing menu and press the **OK** softkey.

Home sensors can be checked moving pusher by means of the **<** and **>** soft keys and watching number of home zone indicated on screen. Zone 0 should be indicated when pusher is at the rightmost position, and zone number shall shift in order to 1, 2, and 3 when moving pusher to the left. Zone 3 indication shall appear not more than 10 mm from the rightmost position and shall be retained all the rest way to the left.

Pusher sensors can be checked pressing smoothly pusher button with finger and watching number of pusher zone indicated on screen (grippers must be in open position). While pusher button is released, the zone C shall be indicated. As pressure on button increases, zone indication shall switch in order to B, and C.

To check unlatch sensor, open pusher grippers and make sure that status of unlatch sensor indicated on the display is OFF. Press the **UNLATCH** softkey. Grippers shall close and status of unlatch sensor shall change to ON.

Once complete press the **BACK** softkey to return to TESTING menu.

3.5.4. Syringe size test

This test is enables checking the operation of syringe size sensor.

Select **Syringe size sensor** from the testing menu and press the **OK** softkey. Slowly lift the syringe clamp. Check if syringe size sensor value changes (mV and mm). Having finished testing press the **BACK** softkey to return to TESTING menu.

3.5.5. Pusher position test

This test enables checking pusher position calibration. Select **Pusher position sensor** from the testing menu and press the **OK** softkey. Insert the SP1 spacer. Press the **OK** softkey. Syringe pusher shall move until coming into contact with the spacer. Pusher position value of (22 ± 0.5) mm should be indicated on the display. Having finished testing press the **BACK** softkey to return to TESTING menu.

3.5.6. Motor test

This test enables checking motor operation. During test no syringe should be installed. Select **Motor** from the testing menu and press the **OK** softkey. Keep the **<** softkey depressed and make sure that pusher moves to the left. Check reverse movement when **>** key is depressed. Having finished testing press the **BACK** softkey to return to TESTING menu.

3.5.7. Display test

This test checks that all of the display pixels (256x64) illuminate. Select **Display** from testing menu and press the **OK** softkey. Observe “chess-board” structure fields that appear in the

display. All the rectangles should be same shaped and evenly filled. Having finished testing press the **BACK** softkey to return to TESTING menu.

3.5.8. Nurse call test

Equipment:

- Nurse call cable (B6650034);
- Ohmmeter.

This test checks the nurse call circuit operation. Select **Nurse call** from testing menu and press the **OK** softkey. Using a meter check the circuit between the Nurse call contact 9 (com) and contacts 10 (NO), 8 (NC). The contacts should toggle each time the **CHANGE** softkey is pressed, as indicated on the display. Press the **BACK** softkey to return to TESTING menu.

3.5.9. Speaker/buzzer test

This test checks the speaker and buzzer operation. Select **Speaker/buzzer** from the testing menu and press the **OK** softkey. Check for the alternating volume sound from the speaker. Check for the sound from the buzzer. Press the **BACK** softkey to return to TESTING menu.

3.5.10. Keypad test

This test enables checking the keypad operation. Select **Keypad** from the testing menu and press the **OK** softkey. Press one by one all keys and make sure that after pressing any key its image on the display is highlighted. Press the **BACK** softkey to return to TESTING menu.

NOTE. This test does not apply to the **ON/OFF** key.

3.5.11. LEDs test

This test is intended to check the LED operation. Select **LEDs** from testing menu and press the **OK** softkey. The following LEDs should activate one after another: GREEN (INFUSION), RED (ALARM), YELLOW (ALERT) and BATTERY. In order to check the operation of BATTERY LED it is necessary to connect the power cable. In order to check the operation of MAINS LED it is necessary to remove and reconnect the power cable. Press the **BACK** softkey to return to TESTING menu.

In order to check the operation of red backup battery LED it is necessary to remove the power supply cable from Main electronic board.

3.5.12. Watch-dog test

This test enables checking of the watch-dog circuit operation. Select **Watch-Dog** from testing menu and press the **OK** softkey. Clocking of the watch-dog circuits is interrupted for certain time. This shall trigger watch-dog, which activates red alarm LED and launches the buzzer. When test completed switch off the pump using the **ON/OFF** key.

4. RECOMMENDED ROUTINE MAINTENANCE AND TESTING

It is recommended that routine maintenance be carried out at least once a year. This should include (see Annex A):

- AC Mains / Battery operational checks (section 4.1).
- General cleaning and inspection for damage (section 4.2).
- Battery test (section 4.3).
- Infusion rate check (section 4.4).
- Occlusion pressure level check (section 4.5).
- Full test (sections 3.4.1-3.4.12).

4.1. AC MAINS / BATTERY OPERATION CHECK

Switch the pump on and plug pump into the mains. Observe that the MAINS indication LED becomes illuminated. Remove the mains supply and observe that the MAINS LED switches off. Observe that the battery indication LED becomes illuminated as the mains supply is removed.

4.2. GENERAL CLEANING AND INSPECTION FOR DAMAGE

To ensure that this pump remains in good operating condition, it is important to keep it clean and carry out the routine procedures described below. Only a qualified service engineer, with reference to this manual, should perform servicing. The following routine maintenance procedures should be carried out as required but at least once per year:

Thoroughly clean external surfaces of the pump before and after prolonged periods of storage by wiping a lint-free cloth lightly dampened with warm water and standard disinfectant/detergent solution.

Disinfectants known to be corrosive to metals and plastics must not be used.

Before cleaning always switch OFF and disconnect from the AC power supply.

Never allow liquid to enter the casing and avoid excessive fluid build up on the pump.

Do not use aggressive cleaning agents as these may damage the exterior surface of the pump.

Do not steam autoclave, ethylene oxide sterilize or immerse this pump in any fluid.

Check Labels should be flat and legible. Replace as required

Case components must be checked for damage that may affect function, present fluid ingress routes and present a user hazard must be replaced as necessary.

Check the mounting clamp is not damaged and that it functions correctly.

Inspect the AC power supply inlet and cable for signs of damage.

4.3. BATTERY TEST

Perform battery calibration in accordance with 3.3.5. When calibration is completed and the battery is fully charged (at least 5 hours on charge) disconnect the pump from the mains. Load 50 ml BD Plastipak syringe with the plunger at 60.0 ml position on the syringe barrel scale. Set the 5.0 ml/h rate and start infusion (see the Operator's Manual for further information on starting the pump).

Normally pump should be able to work on battery for about 10 hours. If this time is significantly less battery should be replaced.

After completion of the test the pump should be recharged for a minimum of 3 hours.

4.4. INFUSION RATE CHECK

Equipment:

- stop-watch;
- graduated glass test-tube (one point equals to 0.1 ml, volume 60ml or more).

Take the BD Plastipak 50 ml syringe with extension set and fill it with distilled water up to point of 60ml. Program the following infusion parameters:

- Rate 50 ml/h.

Insert the free end of extension set into the test-tube and start the infusion. Measure infusion time with the stop-watch till the moment pump display indicates 50 ml infused and stop the infusion.

Read the volume of water delivered into the test-tube. Calculate the infusion rate. It shall be 50ml/h \pm 1ml/h (\pm 2%).

4.5. OCCLUSION PRESSURE LEVEL CHECK

Equipment:

- Digitron pressure meter, model: 2022P (0-1500mmHg).

Fill the 50 ml BD Plastipak syringe with 20-30 ml of the distilled water and connect it to the pressure meter using the extension set. Switch on the pressure meter and set the max/min pressure recording mode.

Set pump occlusion alarm level to L-10 and launch infusion at 5 ml/hr rate (for pump operation details refer to the Operator's Manual).

When pump will stop and indicate OCCLUSION read the maximum pressure recorded by pressure meter. Readings shall be within (73 -117) cmHg range.

If recorded value is outside this range, re-calibrate the force sensor in accordance with 3.3.4 and repeat this test.

5. TROUBLE-SHOOTING

5.1. SAFETY WARNINGS

- Use extreme caution when pump whilst it is connected to the AC mains. Hazardous voltages are present at the mains inlet and on the power supply even the pump is switched off.

- Disconnect the battery and AC power whenever removing or inserting PCBs or other connectors.



- This pump contains static-sensitive components. Wherever the ESD symbol appears observe strict precaution for the protection of static-sensitive components when attempting to service and repair the pump.

- Always visually inspect the pump, power cord and plug for damage. If the power cord or plug is damaged they should be replaced.

5.2. PUMP HAS BEEN DROPPED OR DAMAGED

If the pump is dropped or damaged, the damaged parts should be identified and replaced before any further troubleshooting is carried out.

During inspection, careful attention should be paid to the front and rear case halves, for signs of drop damage. Also check the pump drive, syringe pusher and syringe size sensor.

5.3. PUMP HAS BEEN EXPOSED TO FLUIDS

Excessive fluid spills can lead to fluid ingress into the pump. Even if the fluid dries out, deposits can be left which cause the pump to fail.

If fluid ingress is suspected the pump should be inspected internally.

Clean and dry out the pump.

Take care to ensure dried deposits do not remain on the PCBs or other electrical components. Replace any damaged PCBs or components.

5.4. TROUBLE-SHOOTING BY FAULT SYMPTOM

SYMPTOM	CHECK	CORRECTIVE ACTION
Pump does not operate from external AC mains (MAINS LED does not operate).	Check mains cord. Check switching power supply.	Replace mains cord. Replace switching power supply if necessary.
Pump does not operate from external 12 VDC (MAINS LED does not operate). Pump operates from the AC mains.	Check 12VDC & Nurse call connector unit.	Replace 12VDC & Nurse call connector unit.
One or more keypad key presses are not accepted.	Perform keypad test.	Replace keypad.
Too high or too low contrast level.	Check contrast setting. Check the voltage of the Main Electronics Board test point TP4. The value should be $(-5.8 \pm 0.1)V$, when contrast is set to level 6.	Adjust the contrast as described in Operator's Manual. Adjust voltage by means of R27, if the problem persists – replace the Main Electronic board.
Backlight does not operate when pump is powered on.	Check backlight setting. Check backlight circuit interconnection on Electronic board. Check the Display Unit and its connection to Electronic board connector JP2.	Adjust the backlight as described in Operator's Manual. Replace Main Electronic board if necessary. Replace Display Unit if necessary.
Second (high pitch) audible alarm does not sound after power on.	Check buzzer (Z1) in the Main Electronic board. Check backup battery GB1 in the Main Electronic board.	Replace buzzer (Z1). Replace backup battery GB1.
Grippers do not close when loading syringe.	Perform drive sensors test (Pusher). Check the capacitor C1 and its connection to Drive Unit board. Check the electromagnet circuit and its connection to Drive Unit board.	Replace syringe pusher if necessary. Replace capacitor unit. Replace syringe pusher if necessary.
When loading syringe, after closing grippers the Press lever prompt is displayed.	Perform drive sensors test (Unlatch).	Replace syringe pusher if necessary.

Check syringe prompt is displayed when loading syringe.	Perform drive sensors test (Barrel). Check the syringe barrel sensor connection to Main Electronic board.	Replace syringe barrel sensor if necessary.
Pusher home sensors do not work properly (screen indicates internal malfunction after switching on the pump).	Perform drive sensors test (Home). Check home sensors unit connection to Main Electronic board.	Replace pusher home sensor unit if necessary.
Syringe size sensor does not determine syringe size properly.	Test syringe size sensor (see section 3.4.4). Check the syringe size sensor and its connection to Main Electronic board.	Calibrate syringe size sensor (see section 3.3.1). Replace syringe size sensor if necessary.
Occlusion pressure level incorrect.	Check occlusion pressure level (see section 4.5). Check pressure sensor connection to Drive Unit board. Check pressure sensor amplifier circuit.	Calibrate pressure sensor (see section 3.3.4). Replace syringe pusher if necessary. Replace Drive Unit board if necessary.
Too short operation time on battery.	Test battery (see section 4.3).	Replace battery unit if necessary.
Nurse Call does not operate.	Perform Nurse Call test. Check nurse call circuit interconnection on Power Supply unit.	Replace 12VDC & Nurse call connector unit. Replace Power Supply unit if necessary.
USB interface does not operate.	Check USB connector unit. Check USB cable. Check USB circuits on Main Electronic board.	Replace USB connector unit. Replace USB cable. Replace Main Electronic board if necessary.
IrDA interface does not operate (when link to AIMS 16 is enabled in user configuration menu).	Check the connection of IrDA unit to Main Electronic board. Check IrDA circuits.	Replace IrDA unit if necessary.
Mounting clamp cannot be fixed to the pump.	Check mounting clamp.	Replace mounting clamp.

5.5. TROUBLE-SHOOTING BY FAILURE CODES

CODE	DESCRIPTION	CORRECTIVE ACTION
AB01	During antibolus motor has exceeded the step count limit.	Power off then on. If failure code recurs, replace drive unit board software. If the problem persists, replace drive unit board if necessary.
BAR01	Barrel sensor is damaged.	Check barrel sensor and replace it if necessary.
BP00	Corrupted configuration parameters.	Set default parameters in Service menu/Maintenance menu. If failure code recurs, replace Main electronic board if necessary.
BP01	Configuration parameters out of limits.	Set default parameters in Service menu/Maintenance menu. If failure code recurs, replace Main electronic board if necessary.
BT00	Communications with the battery fuel gauge has failed.	Inspect cables between Battery unit, Power supply unit and Main Electronic board.
BT02	The battery cell voltage is low (less than 1.05V per cell).	Charge battery, if failure code recurs, replace Battery Unit if necessary.
BT03	The battery cell voltage is high (greater than 1.75V per cell).	Check battery charge circuit and replace power supply unit if necessary.
BT04	The battery temperature is high (greater than 60°C).	Check battery charge circuit and replace power supply unit if necessary.
BT05	The battery charging current is high (greater than 1.5A).	Check battery charge circuit and replace power supply unit if necessary.
BT06	The battery discharging current is high (greater than 1.5A).	Disconnect one by one all the connectors, find current leakage place and replace faulty unit.
BT07	The battery is discharging whilst the pump is on the mains.	Inspect cables between battery Monitoring and Power Supply Unit. Check battery charge circuit and replace Power Supply Unit if necessary.
BVXX	Bad variable	Power off then on. If failure code recurs, replace MEB software or Main electronic board if necessary.
EE00	Cannot read/write data from/to external EEPROM	Power off then on. If failure code recurs, replace Main electronic board if necessary.
FL01	Internal Flash timeout	Power off then on. If failure code recurs, replace Main electronic board if necessary.

CODE	DESCRIPTION	CORRECTIVE ACTION
FL03	Internal Flash trap	Power off then on. If failure code recurs, replace Main electronic board if necessary.
HT01	External NMI activated	Power off then on. If failure code recurs, replace MEB software if necessary.
HT02	Stack overflow	Power off then on. If failure code recurs, replace MEB software if necessary.
HT03	Stack upperflow	Power off then on. If failure code recurs, replace MEB software if necessary.
HT04	Internal microcontroller trap activated (Class B)	Power off then on. If failure code recurs, replace MEB software if necessary.
KY01	Keypad key has been depressed for 5 minutes.	Replace keypad if necessary.
LOG1	Key log has failed	Power off then on. If failure code recurs, replace Main electronic board if necessary.
LOG2	Error log has failed	Power off then on. If failure code recurs, replace Main electronic board if necessary.
LOG3	Event log has failed	Power off then on. If failure code recurs, replace Main electronic board if necessary.
OS01	Operating system timeout	Power off then on. If failure code recurs, replace MEB software if necessary.
OTHXX	Other failures	Check log, if necessary replaces MEB software.
PP01	Pusher position readings out of range for the inserted syringe.	Calibrate pusher home and syringe size sensors. If the problem persists, check and replace pusher home sensor or syringe size sensor if necessary.
PP02	Pusher home sensor failure	Check and replace pusher home sensor if necessary.
PP03	Pusher home sensor failure	Check and replace pusher home sensor if necessary.
PR01	Incorrect MEB soft Bootstrap CRC	Power off then on. If failure code recurs, replace MEB Bootstrap software if necessary.
PR02	Incorrect MEB program CRC	Power off then on. If failure code recurs, replace MEB software if necessary.

CODE	DESCRIPTION	CORRECTIVE ACTION
PR03	Program task dead (A certain program task not responding)	Power off then on. If failure code recurs, replace MEB software if necessary. .
PR04	Incorrect motor soft Bootstrap CRC	Power off then on. If failure code recurs, replace drive unit board Bootstrap software.
PR05	Incorrect motor program CRC	Power off then on. If failure code recurs, replace drive unit board software.
RT01	Accuracy of the Drive unit microcontroller quartz clock or Main electronic board microcontroller quartz clock is out of spec. ($\pm 1\%$).	Replace Drive unit board if necessary. Replace Main electronic board if necessary.
RT03	Incorrect date and time settings.	Set date and time.
SA00	Bad MCU (jumps)	Power off then on. If failure code recurs, replace Main electronic board if necessary.
SAXX	Safety failures	Power off then on. If failure code recurs, replace Main electronic board if necessary.
SC01	Interrupted speaker circuit.	Check speaker unit and replace it if necessary. Check speaker drive circuit and replace Main Electronic board if necessary.
SC02	Shorted speaker circuit.	Check speaker unit and replace it if necessary. Check speaker drive circuit and replace Main Electronic board if necessary.
SF01	Syringe force sensor reading out of range.	Calibrate syringe force sensor. If the problem persists: Check syringe force sensor and replace drive with syringe force sensor if necessary. Check syringe force sensor amplifier circuit and replace Drive Unit board if necessary.
SF02	Syringe force test reading out of range.	Calibrate syringe force sensor. If the problem persists: Check syringe force sensor and replace drive with syringe force sensor if necessary. Check syringe force sensor amplifier circuit and replace Drive Unit board if necessary.

CODE	DESCRIPTION	CORRECTIVE ACTION
SF03	Syringe force reference reading out of range.	Calibrate syringe force sensor. If the problem persists: Check syringe force sensor and replace drive with syringe force sensor if necessary. Check syringe force sensor amplifier circuit and replace Drive Unit board if necessary.
SF04	Incorrect CRC of the force (pressure) table	Calibrate syringe force sensor.
SF06	Syringe force reference voltage drift	Calibrate syringe force sensor. If the problem persists: Check syringe force sensor Uref and replace Drive Unit board if necessary.
SM01	Motor software error	Power off then on. If failure code recurs, replace software or drive unit board if necessary.
SM02	Wrong direction of motor rotation	Replace Encoder unit if necessary. Check Drive Unit board and replace it if necessary.
SM03	Motor rotation speed is too high (comparing period of motor steps with encoder signal period)	Check Encoder Unit and replace it if necessary. Check Drive Unit board and replace it if necessary.
SM04	Motor rotation speed is too low (comparing period of motor steps with encoder signal period)	Check Encoder Unit and replace it if necessary. Check Drive Unit board and replace it if necessary. Check motor unit and replace it if necessary.
SM06	Motor no (bad) connection	Inspect cables between Drive unit and Main Electronic board. Replace Drive unit board if necessary.
SM07	Motor timeout	Inspect cables between Drive unit and Main Electronic board. Replace Main electronic board if necessary.
SM08	Motor bad position	Check Encoder Unit and replace it if necessary. Check Drive Unit board and replace it if necessary. Check Main electronic board and replace it if necessary.
SM09	Bad communication protocol number	Power off then on. If failure code recurs, replace motor software if necessary.
SM10	Rate checking algorithm does not work	Power off then on. If failure code recurs, replace motor software and main software if necessary. Check Encoder Unit and replace it if necessary.

CODE	DESCRIPTION	CORRECTIVE ACTION
SP01	Push-button sensors failed	Check pusher sensor unit and replace it if necessary.
SR00	SRAM test failed after power on	Power off then on. If failure code recurs, replace Main electronic board if necessary.
SS01	Syringe size sensor readings out of range	Calibrate syringe size sensor. If the problem persists, check syringe size sensor and replace it if necessary.
SS02	Incorrect CRC of the syringe table in EEPROM	Calibrate syringe size sensor.
SS03	Incorrect CRC of the syringe table in SRAM	Power off then on. If failure code recurs, replace Main electronic board if necessary.
TR02	Internal microcontroller TRAP activated	Power off then on. If failure code recurs, replace MEB software.
TR04	Internal microcontroller TRAP activated	Power off then on. If failure code recurs, replace MEB software.
TR06	Internal microcontroller TRAP activated	Power off then on. If failure code recurs, replace MEB software.
TR10	Internal microcontroller TRAP activated	Power off then on. If failure code recurs, replace MEB software.
WD02	Incorrect W-D circuit outputs after power on	Power off then on. If failure code recurs, replace Main electronic board if necessary.
WD05	Incorrect W-D circuit outputs	Power off then on. If failure code recurs, replace Main electronic board or drive unit board if necessary.
WD06	Incorrect W-D circuit outputs after test	Power off then on. If failure code recurs, replace Main electronic board or drive unit board if necessary.
WD08	W-D software module has failed	Power off then on. If failure code recurs, replace software or Main electronic board if necessary.
WD09	W-D test timeout	Power off then on. If failure code recurs, replace Main electronic board or drive unit board if necessary.
WD10	W-D test not start	Power off then on. If failure code recurs, replace Main electronic board or drive unit board if necessary.
WD11	During W-D test Direction signal remained high.	Power off then on. If failure code recurs, replace Drive unit board or encoder unit if necessary.
WD12	During W-D test W-D first output signal remained high.	Power off then on. If failure code recurs, replace Main electronic board if necessary.

6. REPAIR

Ensure the unit is disconnected from AC power supply and switched off before attempting to service the pump.



The pump contains static-sensitive components. Wherever the ESD symbol appears observe strict precautions for the protection of static-sensitive components when attempting to service and repair the pump.

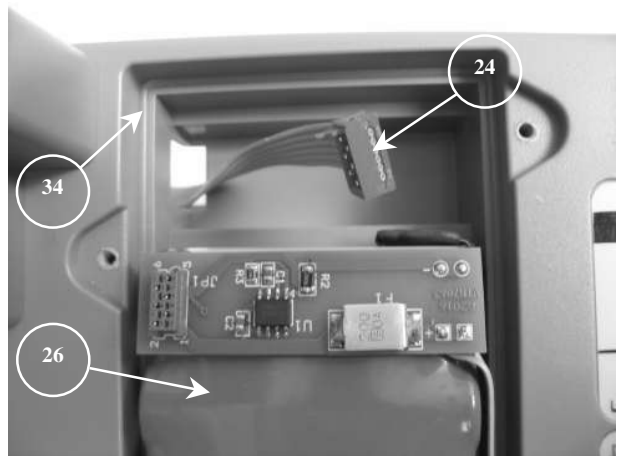
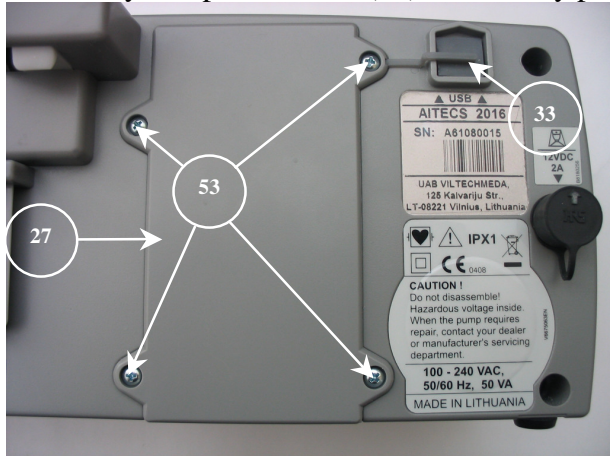
Refer to section 6.4 for torque guidelines. Components may fail or be damaged if not tightened to correct torque level.

During servicing components found to be damaged will require replacement. Follow the instructions below together with the assembly drawings for further information.

Battery should be disposed of as outlined by the local country regulation. Do not send back to the manufacturer.

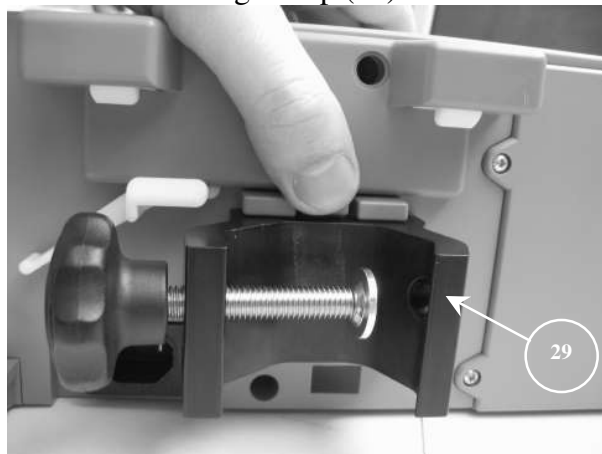
6.1.2. Battery unit replacement

Remove the four battery covers screws (53), remove the battery compartment lid (27), withdraw the battery unit (26) and disconnect the power supply unit (24) cable. Remove USB cap (33) if necessary. Reassemble in the reverse order. When reassembling ensure that the seal (34) under the battery compartment lid (27) is correctly positioned.

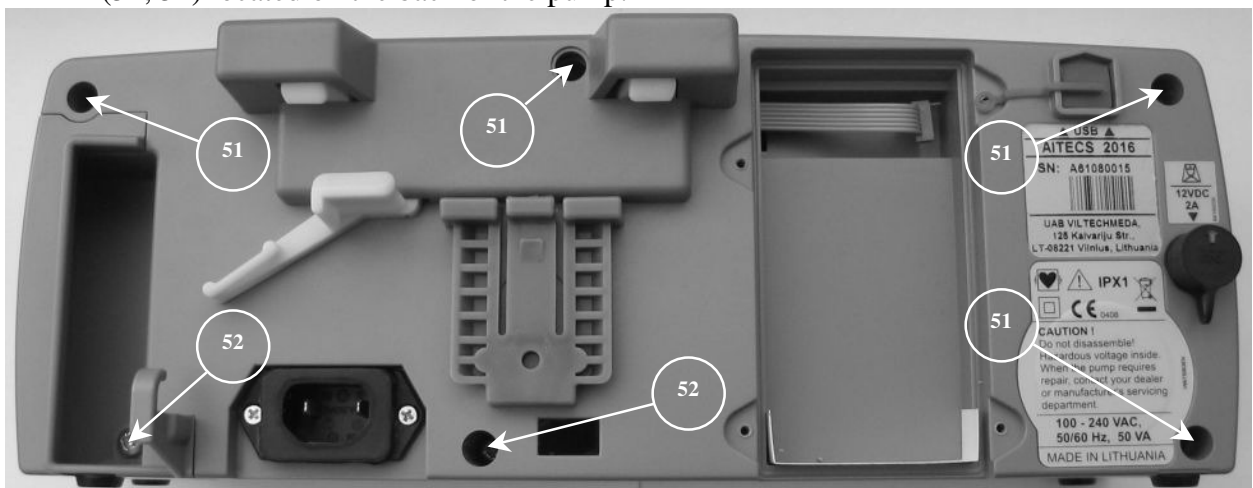


6.1.3. Access to the pump

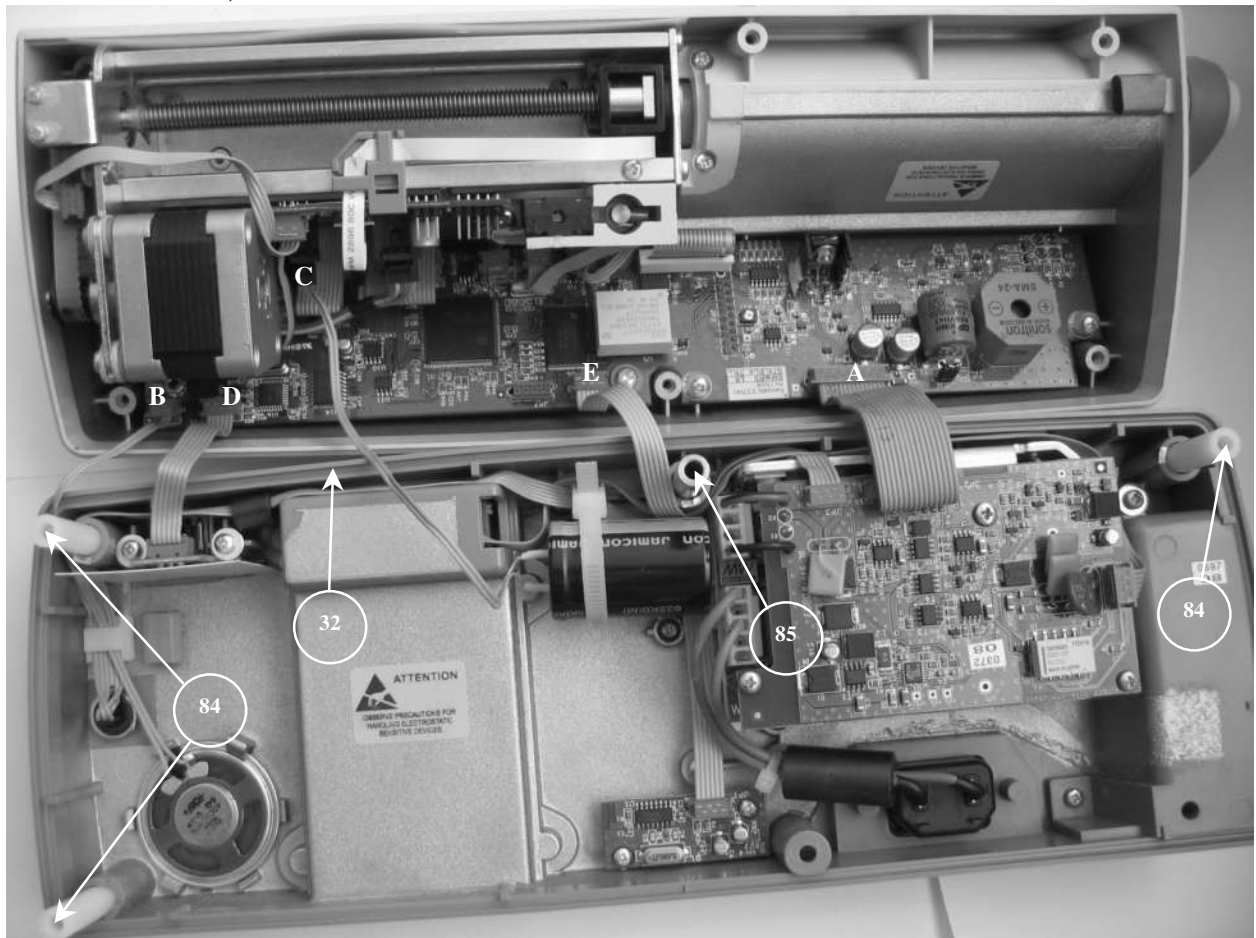
1. Press button and remove the mounting clamp (29).



2. Remove battery unit
3. Place the pump on an anti-static grounded surface. Remove the six case retaining screws (51, 52) located on the back of the pump.



4. Turn the pump upside-down. Carefully separate the front (68) and rear (69) case halves and disconnect the power supply unit cable “A”, the speaker cable “B”, the capacitor cable “C”, the USB cable “D” and IrDA cable “E”.



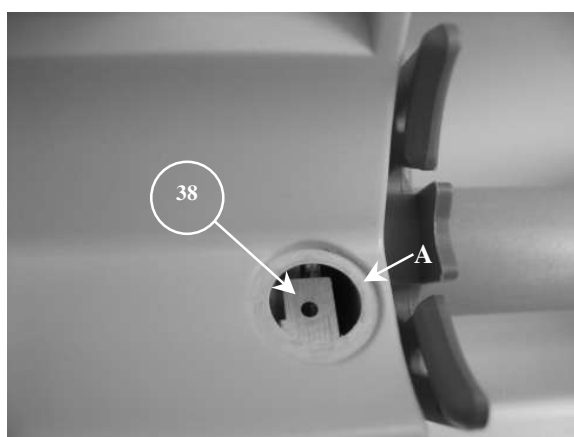
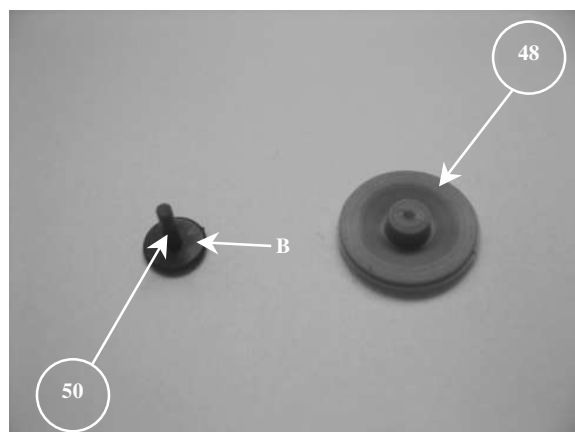
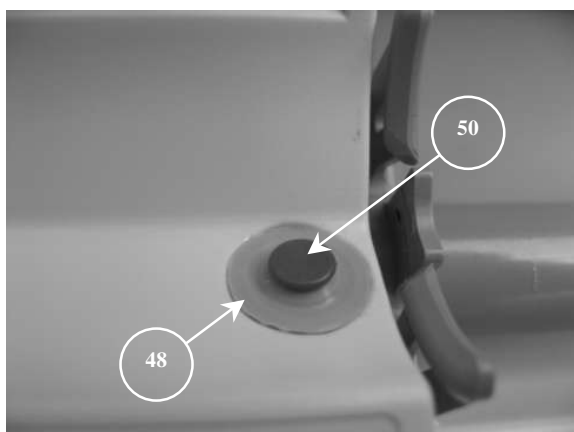
5. Reassemble the pump in the reverse order. When reassembling ensure that the spacers (84) and spacer (85) are correctly inserted. Ensure also that the seal (34) under the battery compartment lid (27) and the seal (32) between the front (68) and rear (69) cases are correctly positioned.

6.2. FRONT CASE AND SUB-ASSEMBLIES

6.2.1. Syringe barrel sensor cap replacement

1. Use a knife to find the edge of the gasket (48) and carefully peel it back.
2. Using isopropyl alcohol clean the case ensuring all old adhesive residue is removed from the surface "A" where the gasket (48) will be positioned.
3. Apply the LOCTITE-4850 glue on the surface "B" of the cap (50) that will contact the gasket (48) and put the cap and gasket together.
4. Apply the LOCTITE-4850 glue on the surface "A" (recess) of the case that will contact the gasket (48).
5. Install the gasket (48) with cap (50) so that pin of the cap (50) goes through the hole in the spring (38) and press the gasket (48) so that it sticks to the case.

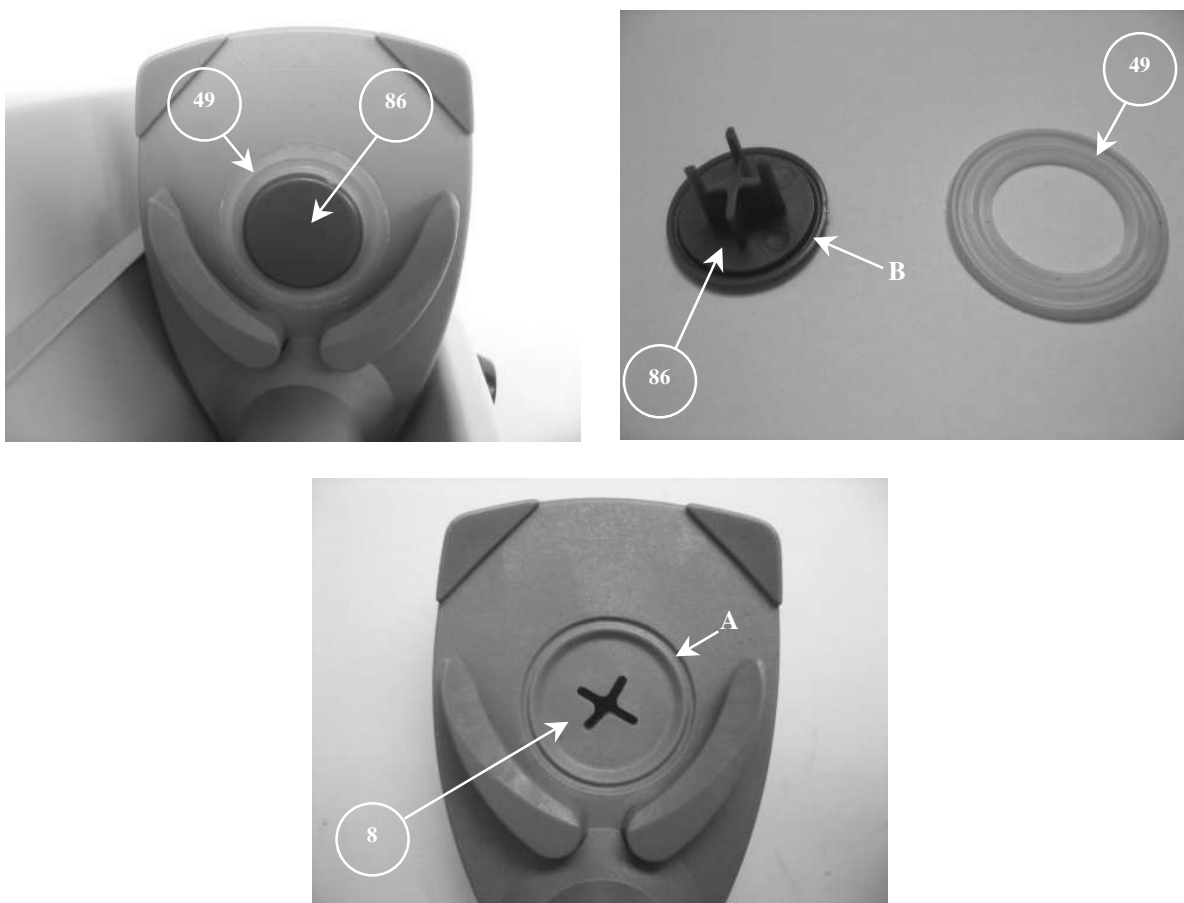
NOTE. When applying glue take care that it is not spread beyond area to be glued. Putting glue on the membrane surface is inadmissible.



6.2.2. Plunger push-button replacement

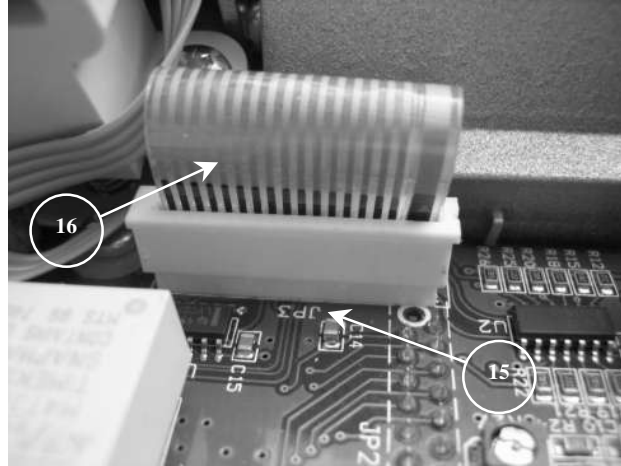
1. Use a knife to find the edge of the gasket (49) and carefully peel it back.
2. Using isopropyl alcohol clean the groove “A” on the pusher (8) ensuring all old adhesive residue is removed from the surface where the gasket (49) will be positioned.
3. Apply the LOCTITE-4850 glue on the groove “B” on the push-button (86) and put the push-button together with the gasket (49).
4. Apply the LOCTITE-4850 glue on the groove “A” on the pusher (8).
5. Install push-button (86) so that guides of push-button (86) go through the cross recess in the pusher (8) and press the gasket (49) so that it sticks to the pusher (8).

NOTE. When applying glue take care that it is not spread outside the grooves. Putting glue on the membrane surface is inadmissible.



6.2.3. Keypad replacement

1. Open the Main Electronic board (15) connector's JP3 actuator. Detach the flexi-cable of the keypad K1 (16) from the Main Electronic board (15) connector JP3.



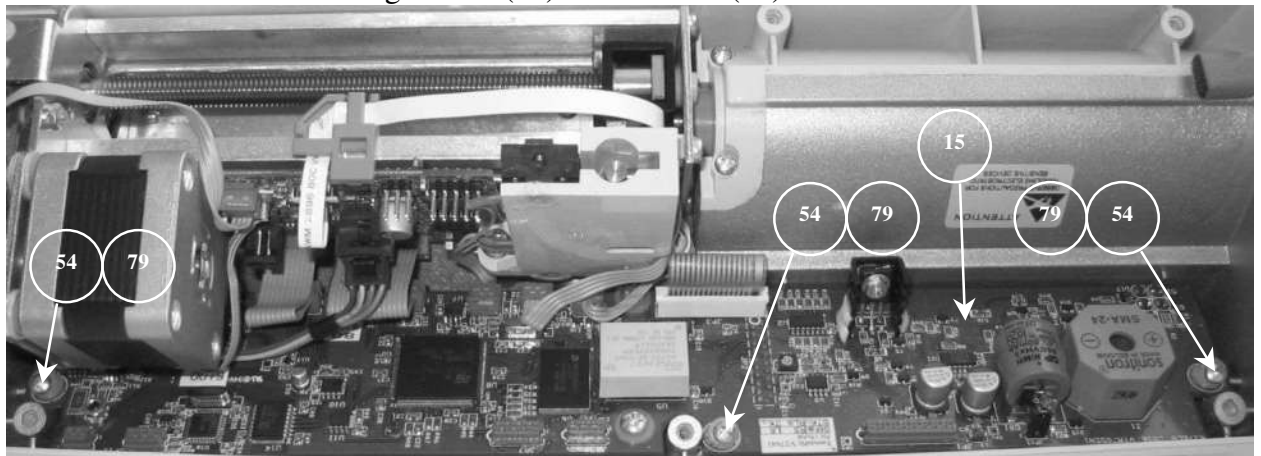
2. Carefully access the edge of the keypad, peel it back.
3. Using isopropyl alcohol clean the case where the keypad will be positioned ensuring all old adhesive residue is removed.
4. Remove the protective film from the keypad. Insert the keypad K1 (16) flexi-cable through the appropriate case slot.



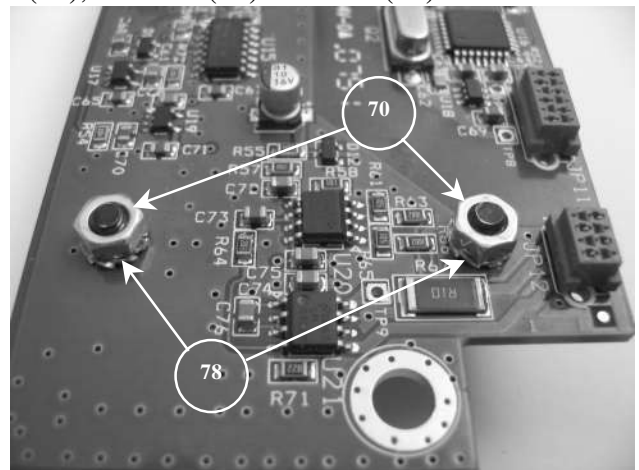
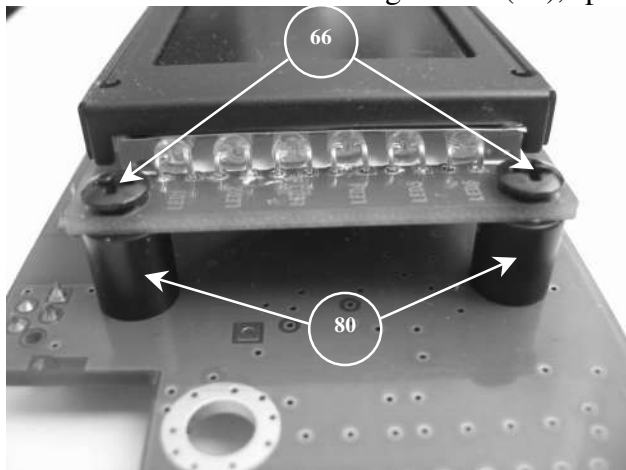
5. Align the bottom edges and corners of the keypad K1 (16) with the recess in the case. Stick the keypad K1 (16) by pressing it firmly with a soft cloth, starting from bottom edge working to the top.
6. Connect the keypad K1 (16) flexi-cable to the Main Electronic board (15) connector JP3 and lock the actuator.

6.2.4. Main Electronic board and Display unit replacement

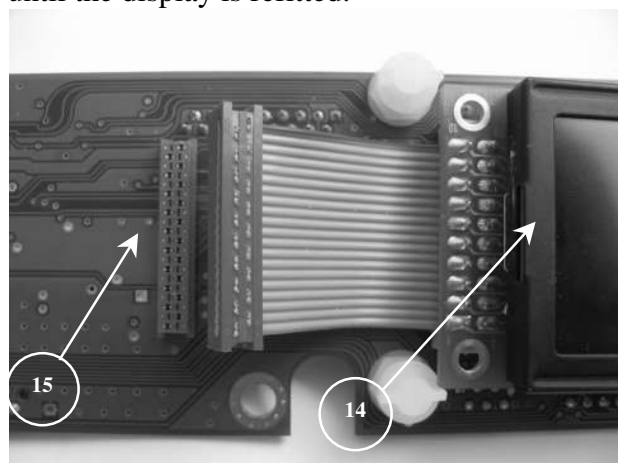
1. Remove the three retaining screws (54) and washers (79).



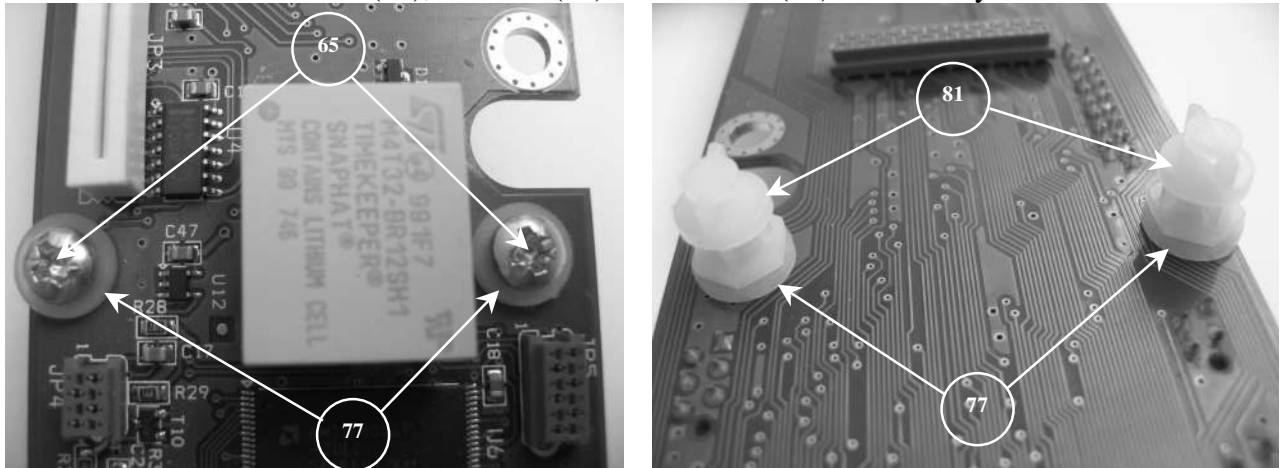
2. Disconnect all flexi and cable connections from the Main Electronic board (15).
3. Carefully withdraw the Main Electronic board (15) with Display unit (14) from the front case.
4. Remove two retaining screws (66), spacers (80), washers (78) and nuts (70).



5. Disconnect the Display unit (14) cable. Detach Display unit (14) from the Main Electronic board (15). Ensure that the display panel and case panel remain protected from dust and scratches until the display is refitted.



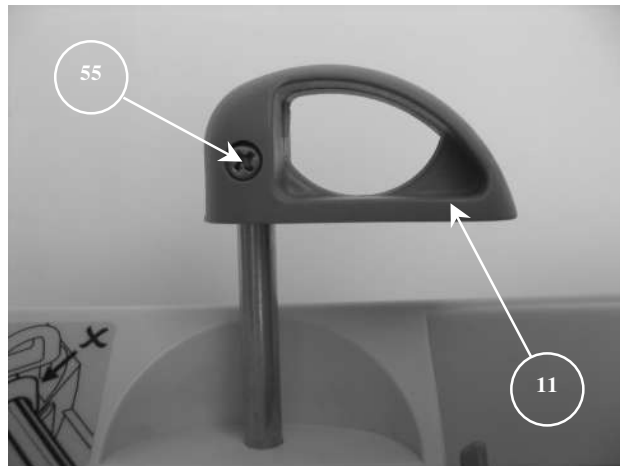
6. Remove the screws (65), standoff (81) and washers (77) if necessary.



7. Fit the display unit (14) on the Main Electronic board (15) in reverse order.
8. Connect Display unit (14) cable. Remove the protective film from the display.
9. Carefully insert the Main Electronic board (15) with Display unit (14) into the front case.
10. Fit the three retaining screws (54) and washers (79).
11. Connect all flexi and cable connections to the Main Electronic board (15).
12. Perform calibration procedures in accordance with the 3.3.1.-3.3.4. Perform date and time setting procedure in accordance with Operator's Manual.

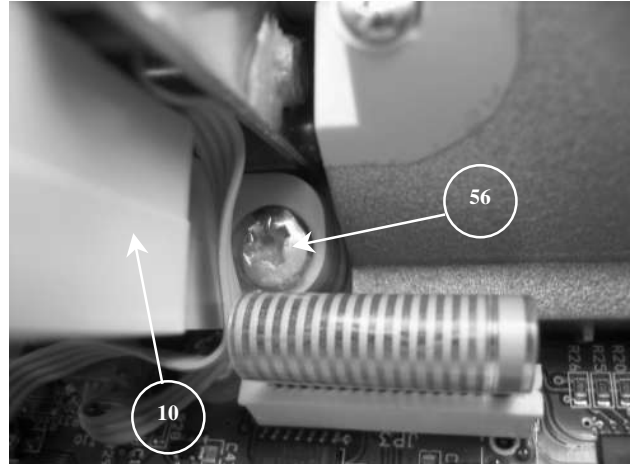
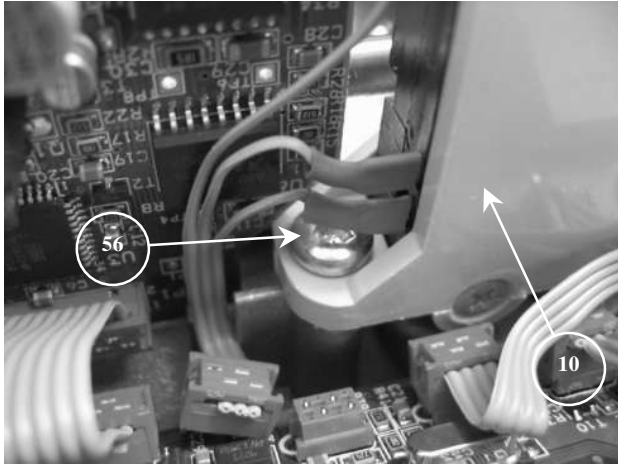
6.2.5. Syringe clamp replacement

1. Lift the syringe clamp (11) to the upper position and hold it in this position.
2. Unscrew the syringe clamp screw (55) and remove the syringe clamp (11).
3. Reassemble in reverse order.

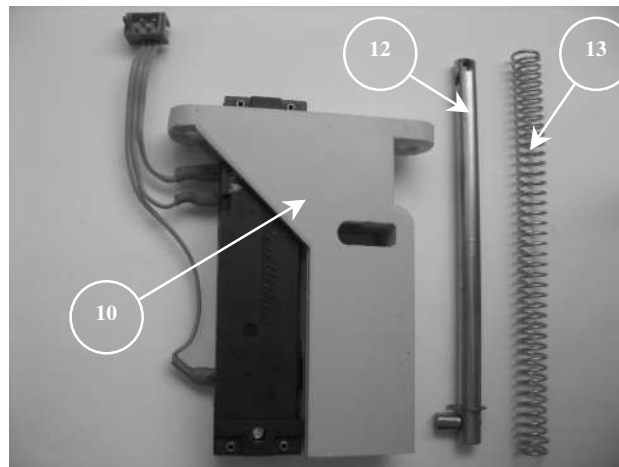


6.2.6. Syringe size sensor replacement

1. Remove the syringe clamp.
2. Disconnect the syringe size sensor (10) cable.
3. Remove the two retaining screws (56) and carefully withdraw the syringe size sensor (10).



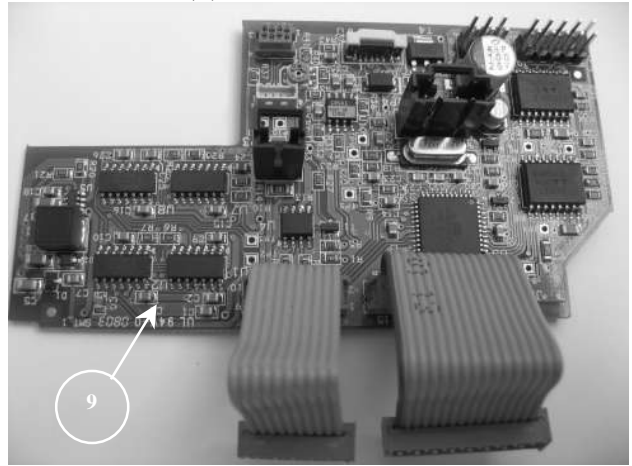
4. Remove the axis (12) and the spring (13).



5. Reassemble in reverse order. Perform syringe size sensor calibration procedure in accordance with the 3.3.1.

6.2.7. Drive Unit board replacement

1. Remove the syringe size sensor.
2. Disconnect the Drive Unit's board flexi-cable and cable connections.
3. Insert small flat screwdriver into opening on the holder of flexi-cable (37) and unlatch it and put aside. Carefully withdraw the Drive Unit board (9) from the front case.

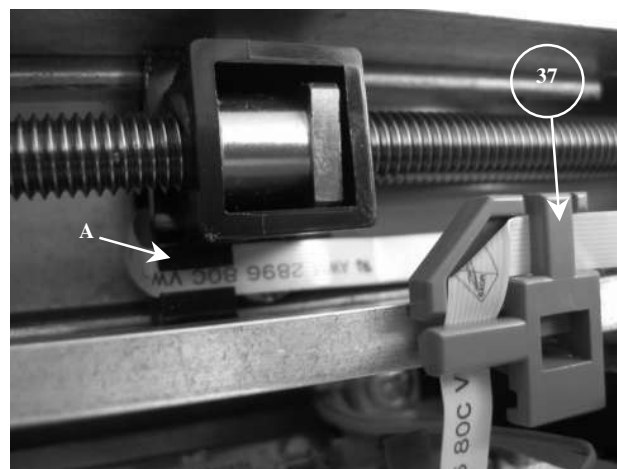


4. Reassemble in reverse order.

NOTE. Drive Unit board replacement entails necessity of syringe pressure sensor calibration. Perform it at the final stage of pump reassembling prior to joining front and rear cases, since it may be necessary to adjust trimmer potentiometer R41 on the Drive Unit board. Restore power supply unit and capacitor unit connection between front and rear cases of the pump and put the cases vertically on the table as far apart as the length of cable allow. Perform force sensor calibration procedure in accordance with the 3.3.4.

6.2.8. Syringe pusher replacement

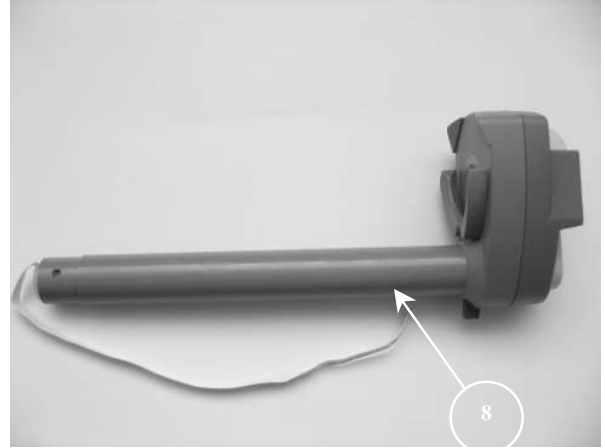
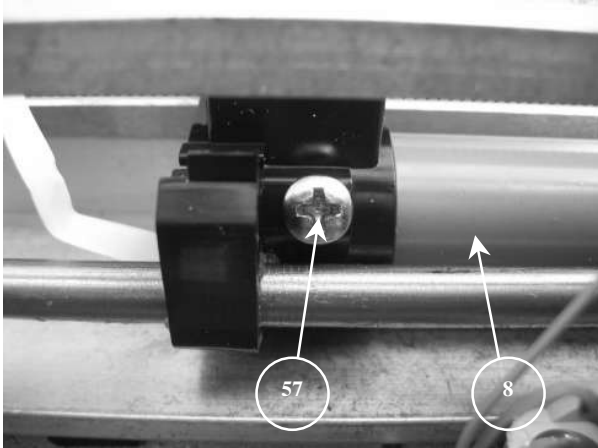
1. Remove the Drive Unit board.
2. Withdraw the flexi-cable out of holder (37) and out of carriage "A".



3. Remove the retaining screw (57).

NOTE. To have good access to the screw (57), move syringe pusher (8) to appropriate position rotating motor shaft manually.

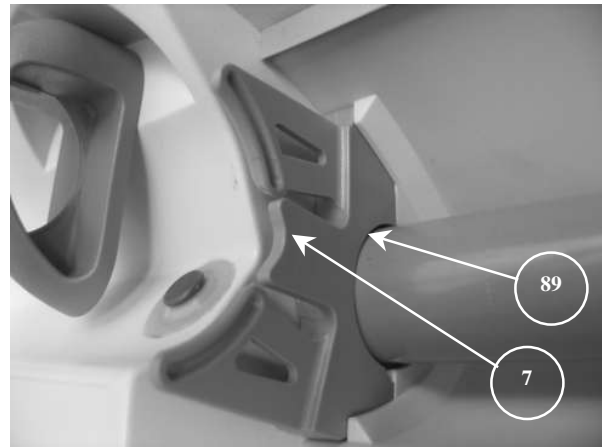
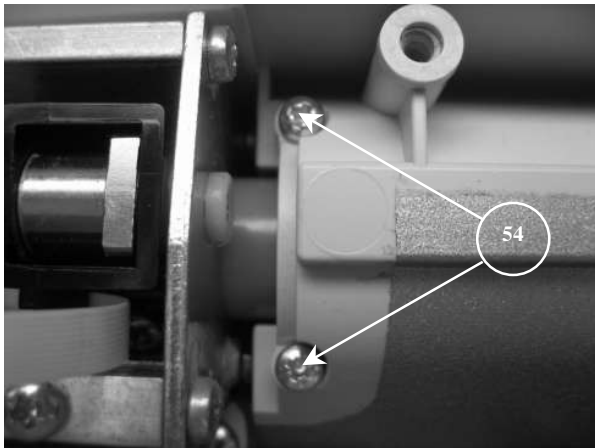
4. Slightly unscrew the syringe support retaining screws (see 6.2.9).
5. Remove syringe pusher (8).



6. Reassemble in reverse order.

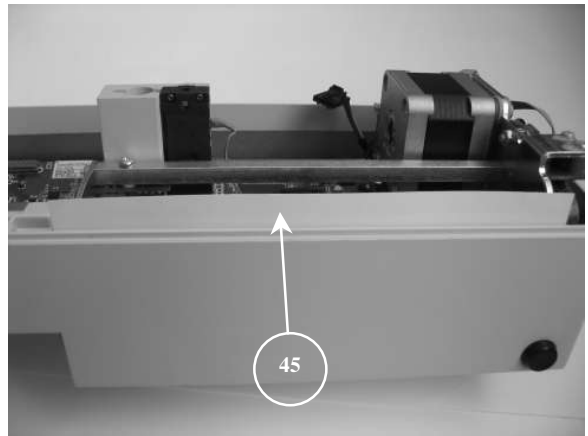
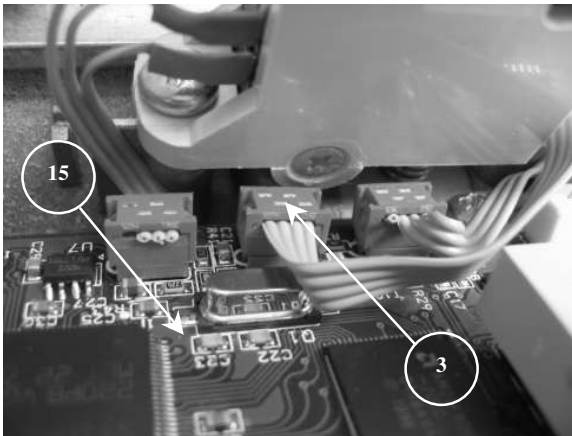
6.2.9. Syringe support replacement

1. Remove the two retaining screws (54).
2. Remove the syringe support (7) with sealing tube (89).
3. Reassemble in reverse order.

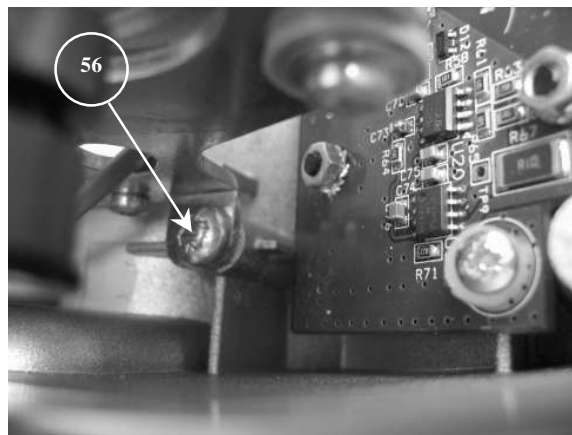
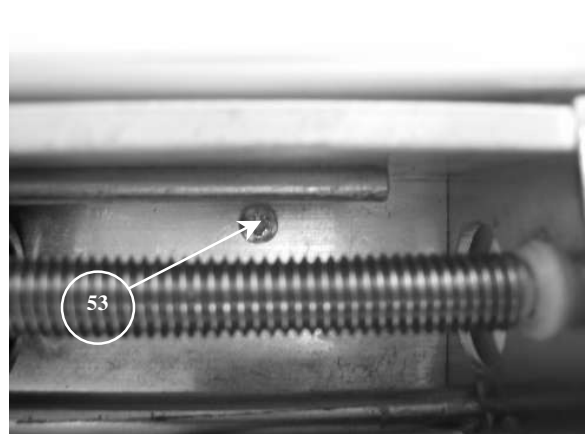
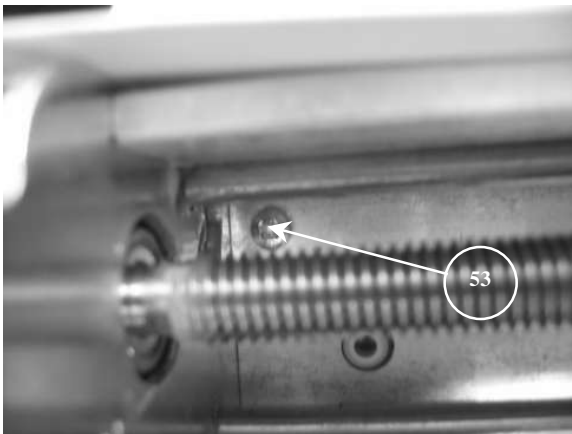


6.2.10. Drive replacement

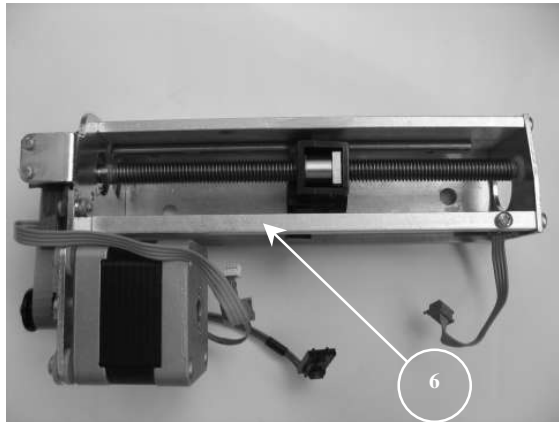
1. Remove the syringe pusher.
2. Disconnect the pusher home sensor unit (3) cable from Main Electronic board (15).
3. Remove plate (45).



4. Remove the retaining screws (53, 58).



5. Carefully withdraw the drive (6) from the front case.



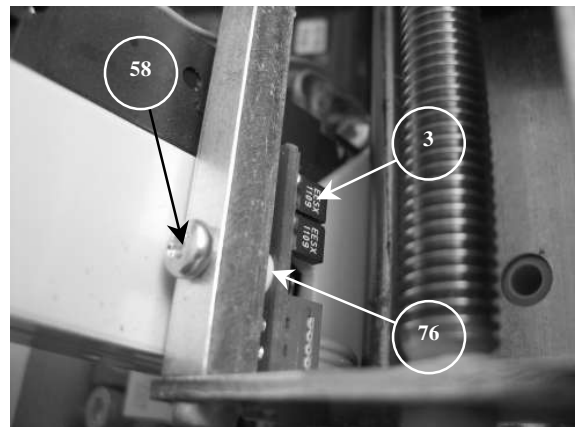
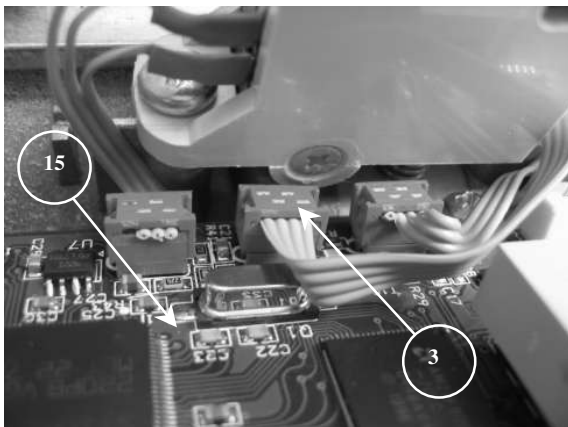
6. Reassemble in reverse order.

6.2.11. Pusher home sensor unit replacement

1. Disconnect the pusher home sensors unit's (3) cable from the Main electronic board (15).

2. Remove the retaining screw (58), spacer (76) and pusher home sensors unit (3).

NOTE. If the carriage is obstructing access to the pusher home unit, move syringe pusher (14) to appropriate position rotating motor shaft manually.



3. Reassemble in reverse order.

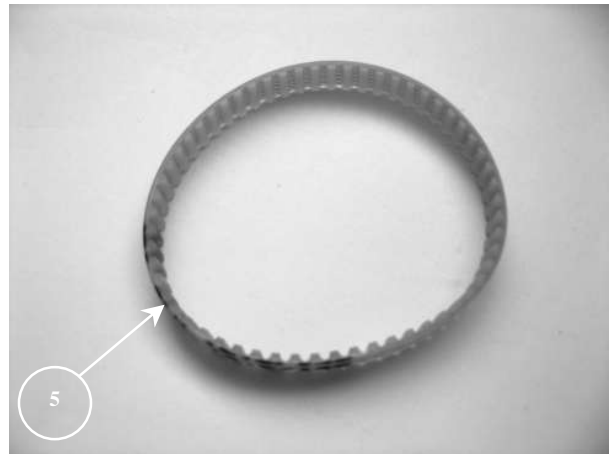
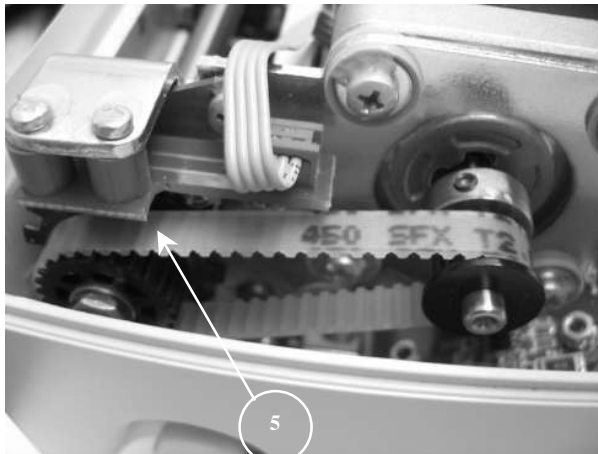
NOTES:

1. Attention! Pusher home sensor unit's cable shall be plugged into JP6 receptacle on the Main Electronic Board.

2. Make sure that shutter on the carriage passes freely through the slots of optical sensors not contacting them. That shall be checked rotating motor shaft manually.

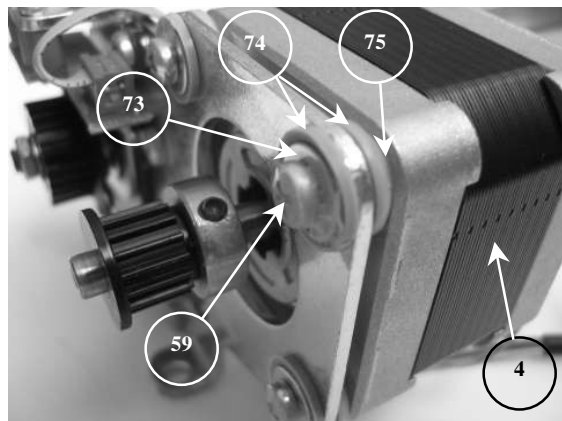
6.2.12. Motor belt replacement

1. Pull off motor belt (5) from the bigger pulley.
2. Remove the motor belt (5).
3. Reassemble in reverse order.



6.2.13. Motor unit replacement

1. Remove the drive. Remove the motor belt.
2. Remove the four screws (59), eight dampers (74), four spacers (75) and four washers (73). Remove motor unit (4).

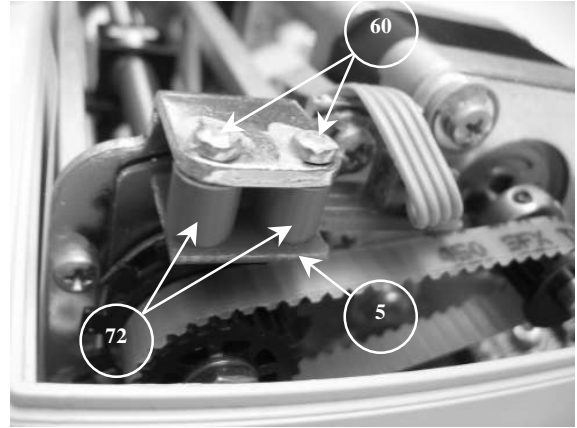
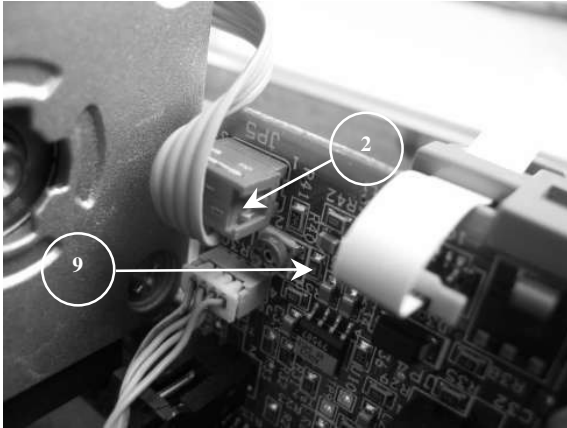


3. Reassemble in reverse order.

6.2.14. Encoder unit replacement

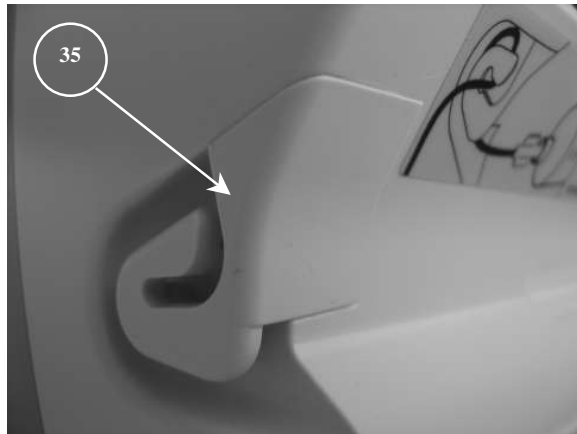
1. Disconnect the encoder unit (2) cable from Drive Unit board (9).
2. Remove the screws (60), spacers (72) and the encoder unit (2).
3. Reassemble in reverse order.

NOTE. When tightening screws (60) adjust position of encoder unit so that tips of encoding disk would go through the very middle of slot of each optical sensor.



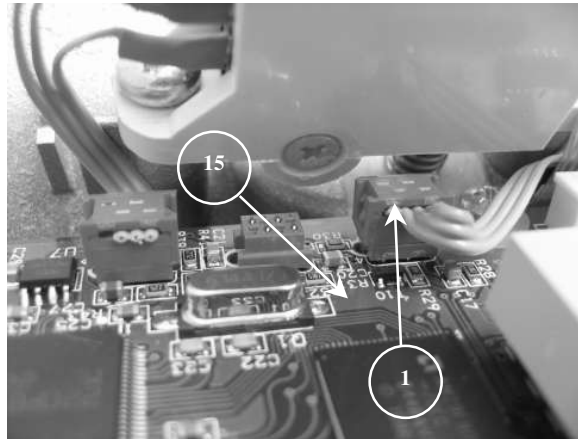
6.2.15. Extension set retainer

1. Carefully using knife detach extension set retainer (35) from the case.
2. Using isopropyl alcohol clean the case surface ensuring all old adhesive residues is removed where the linijos laikiklis (35) will be positioned.
3. Glue the extension set retainer (35) using instant glue.

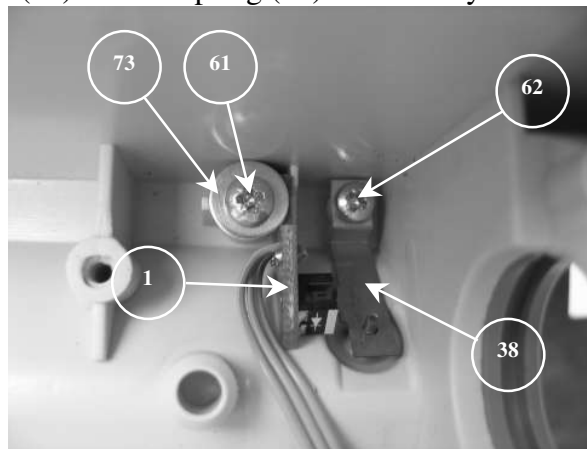


6.2.16. Syringe barrel sensor unit replacement

1. Remove the drive.
2. Disconnect the syringe barrel sensor unit (1) cable from Main electronic board (15).



3. Remove the screw (61) and washer (73).
4. Remove syringe barrel sensor unit (1).
5. Remove the screw (62) and the spring (38) if necessary.



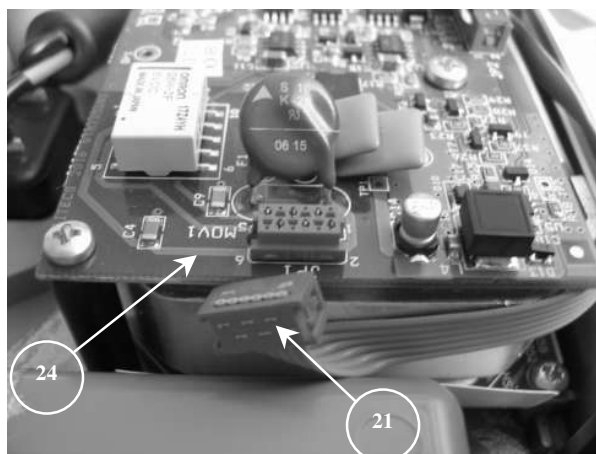
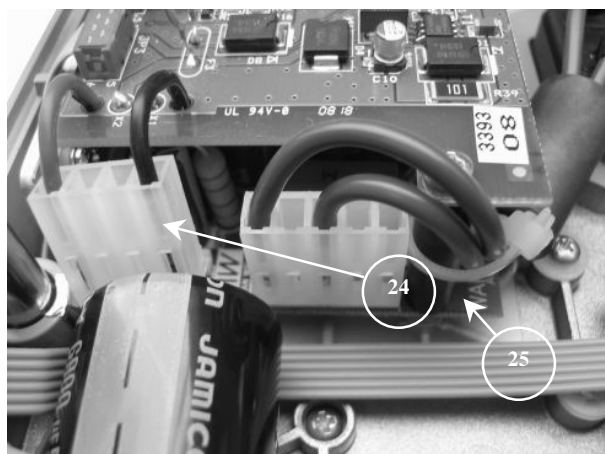
6. Reassemble in reverse order.

NOTE. *Attention! Syringe barrel sensor unit's cable shall be plugged into JP4 receptacle on the Main Electronic Board.*

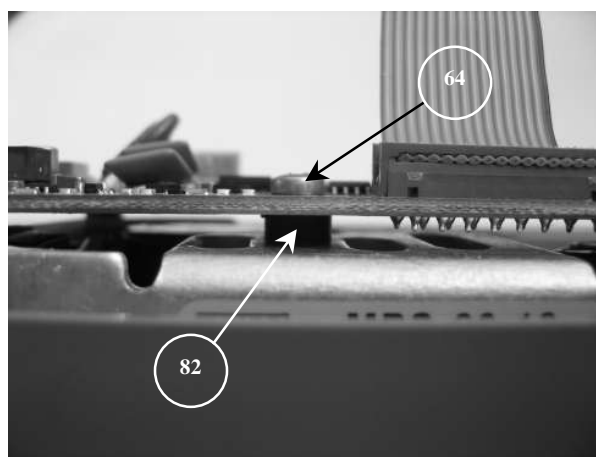
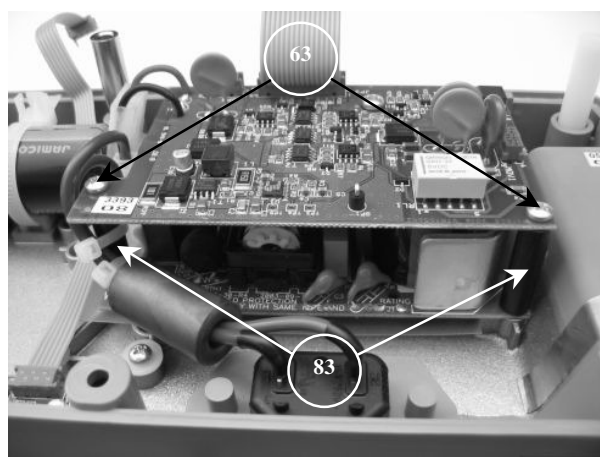
6.3. REAR CASE AND SUB-ASSEMBLIES

6.3.1. Power supply unit supply and switching power supply replacement

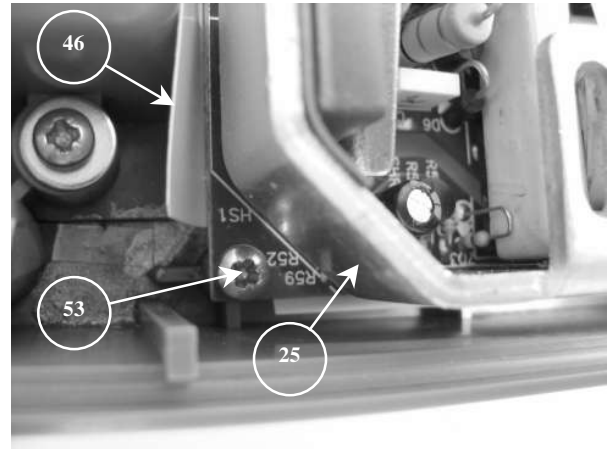
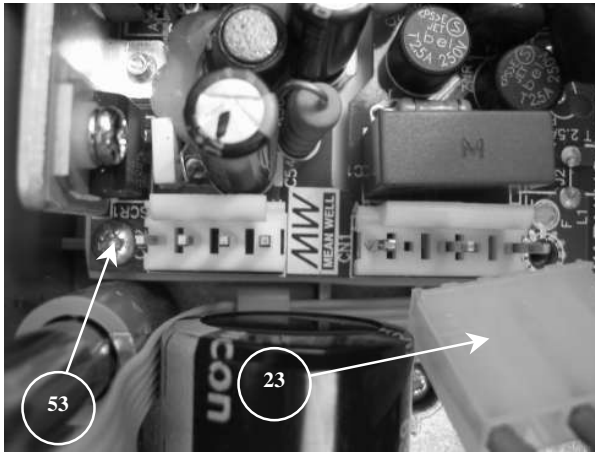
1. Remove the four screws (53), remove the battery compartment lid (27), disconnect the power supply unit (24) cable and withdraw the battery unit (26). *See chapter 6.1.2.* Remove the power supply unit (24) cable from the battery unit compartment.
2. Disconnect power supply unit (24) connection from the switching power supply (25).
3. Disconnect the 12VDC & Nurse call unit (21) connection from power supply unit (24).



4. Remove three retaining screws (63, 64) and spacers (82, 83). Carefully withdraw the Power supply unit (24) from the rear case.



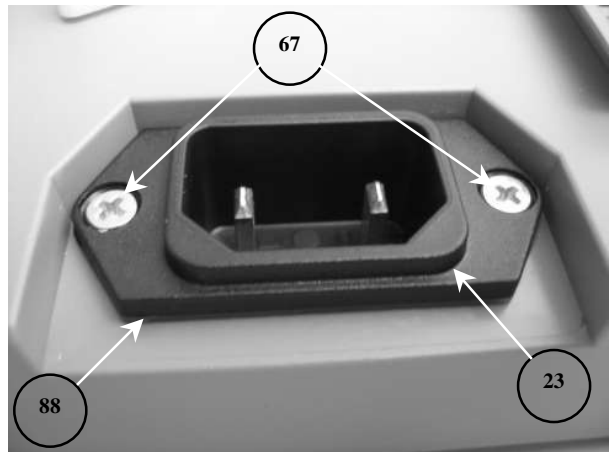
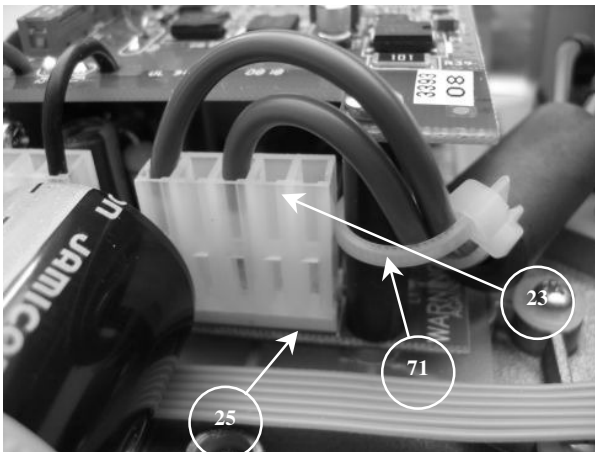
5. Disconnect the mains inlet unit (23) connection.
6. Remove the two retaining screws (53).
7. Remove the switching power supply (25). Remove plate (46) if necessary.



8. Reassemble in reverse order.

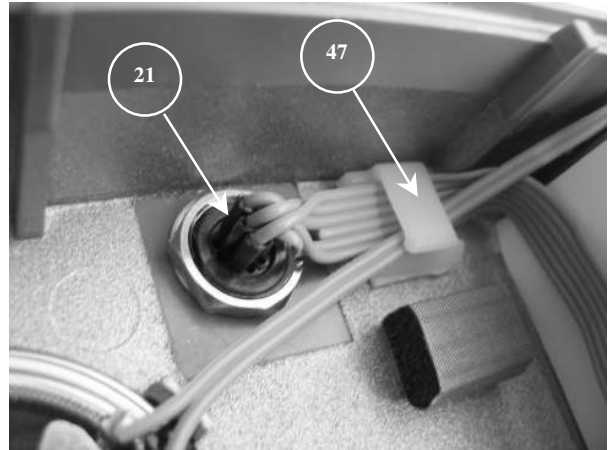
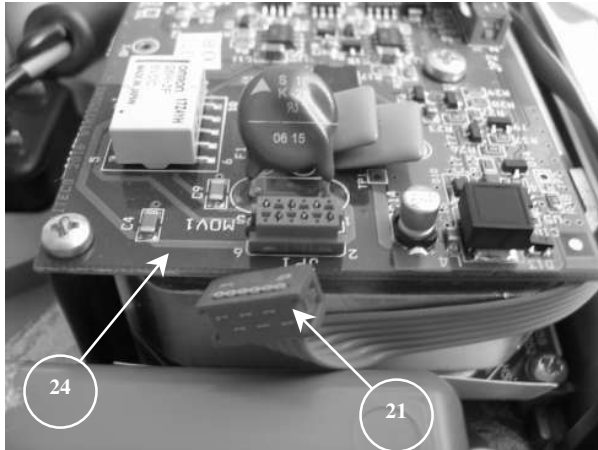
6.3.2. Mains inlet unit replacement

1. Cut the tie (71).
2. Detach the mains inlet unit (23) connector from the switching power supply (25).
3. Remove the two retaining screws (67).
4. Carefully withdraw the mains inlet unit (23) from the rear case.
5. Remove plate (88).
6. Reassemble in reverse order (fix the tie (71)).



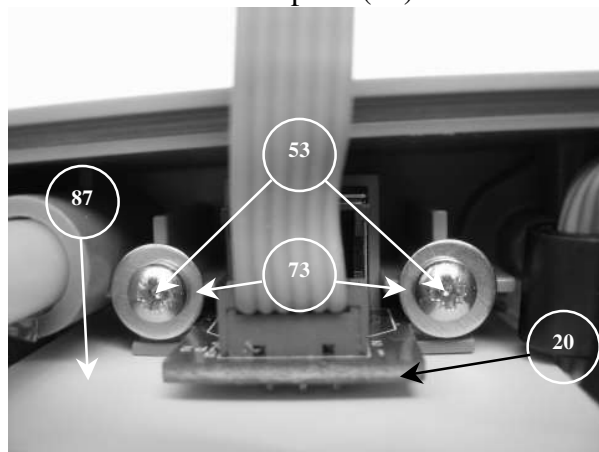
6.3.3. 12VDC & Nurse call unit replacement

1. Disconnect the 12VDC & Nurse call unit (21) cable from Power supply unit (24) and detach from holder (47).
2. Remove the 12VDC & Nurse call unit (21) retainer screw and withdraw the 12VDC & Nurse call unit (21). Remove cap (22) if necessary.
3. Reassemble in reverse order.



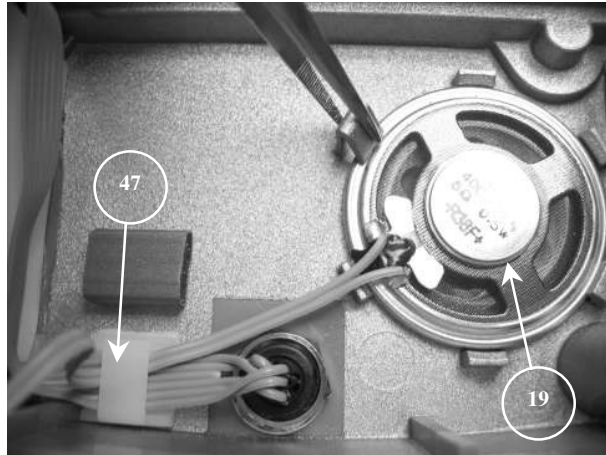
6.3.4. USB unit replacement

1. Remove two screws (53), washers (73) and carefully withdraw the USB unit (20). Remove plate (87) if necessary.
2. Reassemble in reverse order. Glue new plate (87).



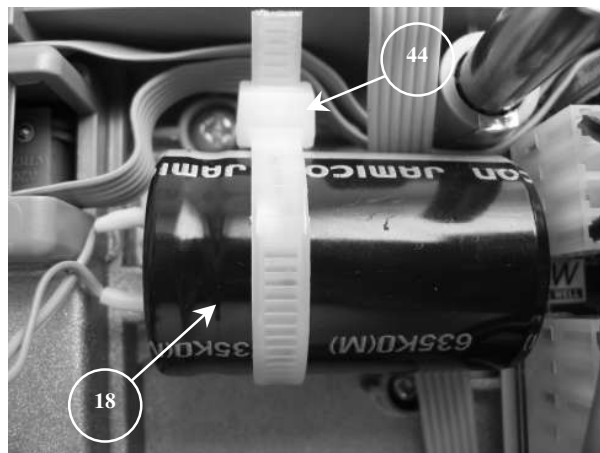
6.3.5. Speaker unit replacement

1. Using tweezers squeeze the plastic hook that holds the speaker unit (19) and carefully detach it from the case and withdraw its cable out of holder (47).
2. Reassemble in reverse order.



6.3.6. Capacitor unit replacement

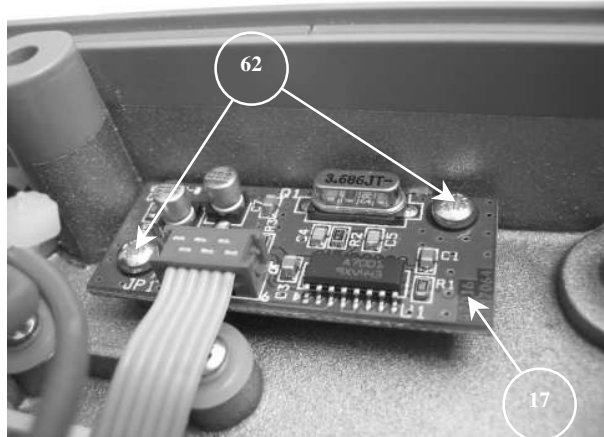
1. Detach the tie (44) and carefully withdraw the capacitor unit (18).



2. Reassemble in reverse order.

6.3.7. IrDA unit replacement

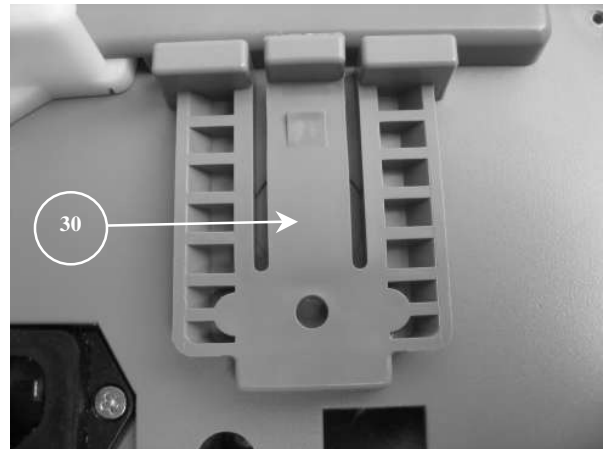
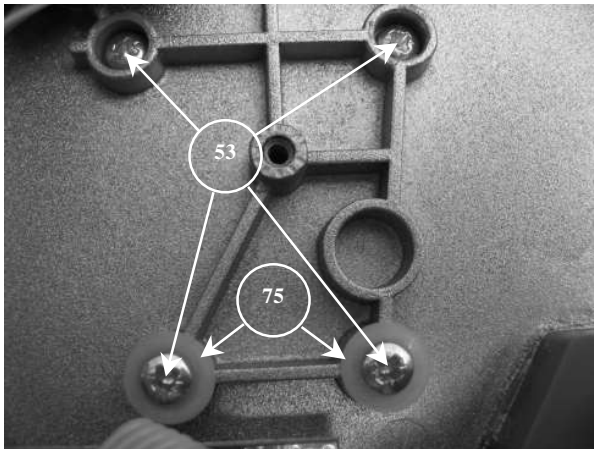
1. Remove capacitor unit.
2. Remove the two screws (62) and carefully withdraw the IrDA unit (17).



3. Reassemble in reverse order.

6.3.8. Mounting clamp holder replacement

1. Remove the power supply unit. Remove the switching power supply.
2. Remove the screws (53) and washers (75). Remove the mounting clamp holder (30).

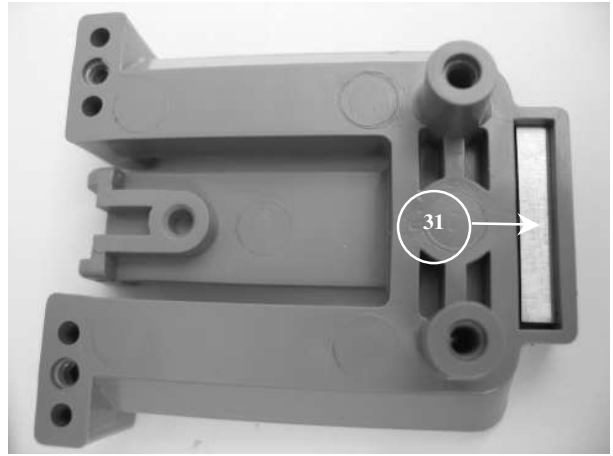
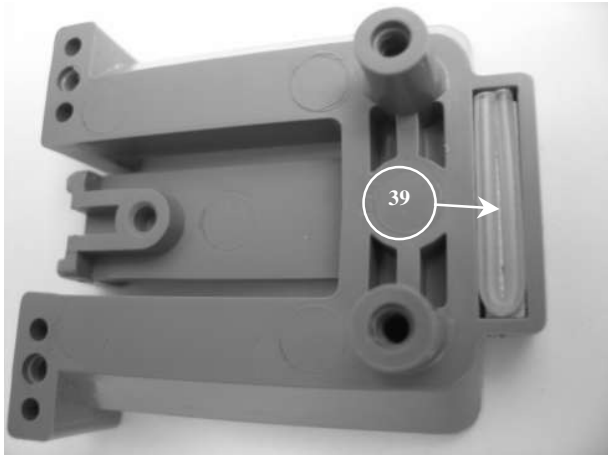


3. Reassemble in reverse order.

NOTE. Take care not to lose the magnet and silicon gasket that are inside the mounting clamp holder.

6.3.9. Magnet replacement

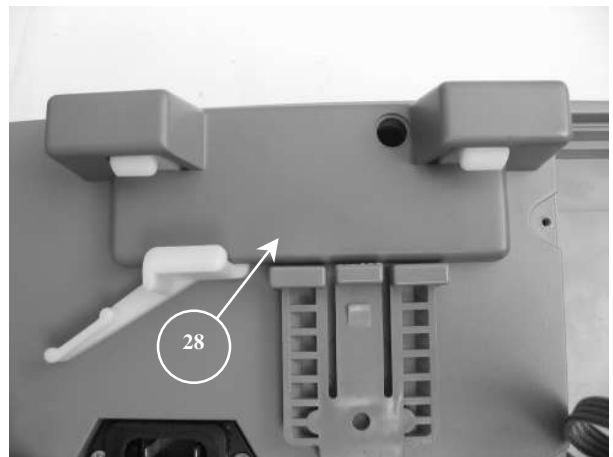
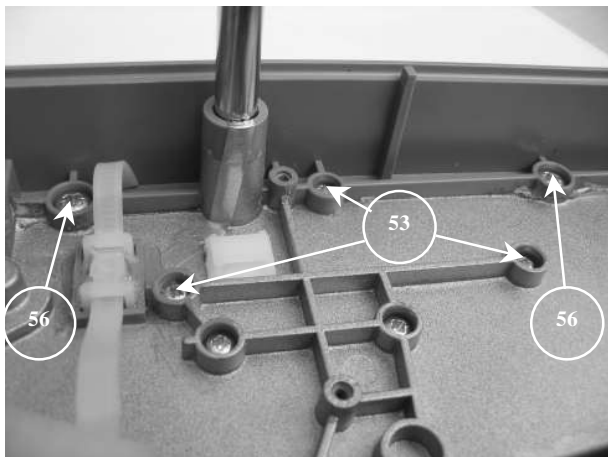
1. Remove mounting clamp holder.
2. Remove silicon gasket (39) and the magnet (31).



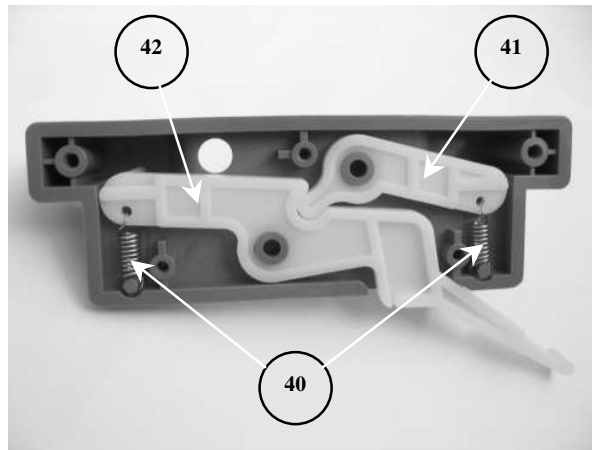
3. Reassemble in reverse order.

6.3.10. Dragger bar clamp's case, levers and springs replacement

1. Remove the power supply unit. Remove the switching power supply. Remove the capacitor unit.
2. Remove the screws (56) and (53).
3. Remove case (28).



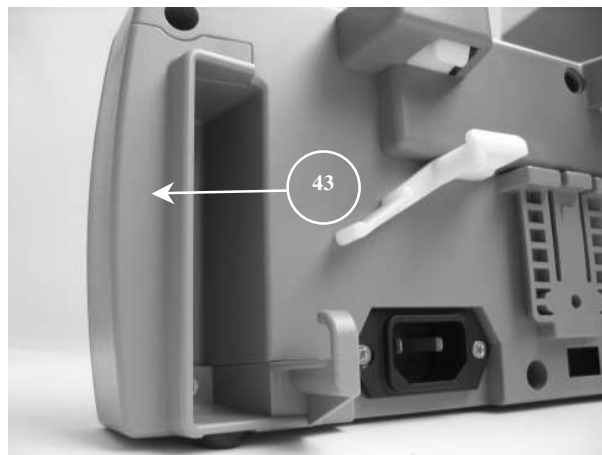
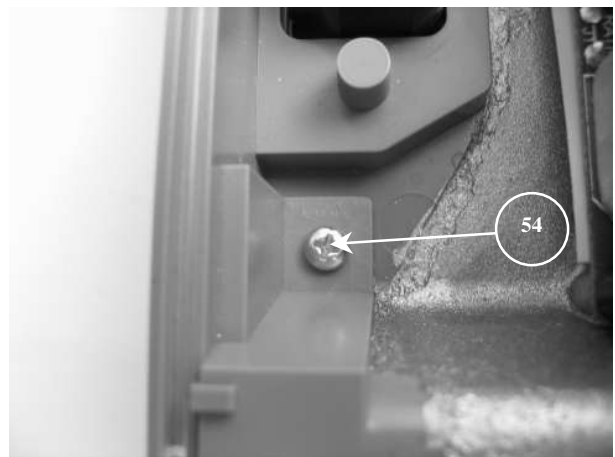
4. Remove springs (40), lever (41) and lever (42) if necessary.



5. Reassemble in reverse order.

6.3.11. Carrying handle replacement

1. Remove the screws (61, 54) and washer (73).
2. Remove carrying handle (43).
3. Reassemble in reverse order.



6.4. TORQUE GUIDE

The following list outlines the torque levels established during product manufacture. NOTE: These values are for the first insertion of screws and fasteners. When selecting a torque for servicing activity, be aware that refastening will require slightly less torque than the initial manufacture.

Over-tightening of screws and fasteners can cause damage. The manufacturer cannot be held responsible for such damage caused.

Front Case Assembly:

Stage Description	Component Description	Part No	Qty	Established Process Torque
Secure Main electronic board	Screw ISO 7049 Ø2,9x13	B1000220	3	0,7 Nm
Secure display unit	Screw ISO 7045 M3x16	B1000013	2	0,7 Nm
	Nut ISO 4032 M3	B1001030	2	0,7 Nm
	Screw Ø3,5 l=8	B1000243	2	1 Nm
Secure syringe clamp	Screw DIN966 M2,5x10	B1000112	1	0,5 Nm
Secure syringe size sensor	Screw BN82428 Ø4x12	B1000235	2	1,5 Nm
Secure syringe pusher	Screw ISO 7049 Ø3,5x25	B1000225	1	1 Nm
Secure syringe support	Screw ISO 7049 Ø2,9x13	B1000220	2	0,7 Nm
Secure drive	Screw BN82428 Ø4x12	B1000235	1	1,5 Nm
	Screw ISO 7049 Ø2,9x9,5	B1000219	2	0,7 Nm
Secure pusher home sensor unit	Screw BN82428 Ø3x10	B1000227	1	0,7 Nm
Secure motor unit	Screw ISO 7045 M3x10	B1000045	4	0,7 Nm
Secure encoder unit	Screw BN82428 Ø2,5x12	B1000205	2	0,5 Nm
Secure barrel sensor	Screw BN82428 Ø3x8	B1000226	1	0,7 Nm
Secure barrel spring	Screw BN82428 Ø2,5x6	B1000203	1	0,5 Nm

Rear Case Assembly:

Stage Description	Component Description	Part No	Qty	Established Process Torque
Secure power supply unit	Screw Ø3x35	B1000244	2	0,7 Nm
	Screw DIN7985 Ø3x8	B1000043	1	0,7 Nm
Secure switching power supply	Screw ISO 7049 Ø2,9x9,5	B1000219	2	0,7 Nm
Secure mains inlet unit	Screw DIN7982 Ø2,9x9,5	B1000218	2	0,7 Nm

Secure USB connector unit	Screw ISO 7049 Ø2,9x9,5	B1000219	2	0,7 Nm
Secure IrDA unit	Screw BN82428 Ø2,5x6	B1000203	2	0,5 Nm
Secure mounting clamp holder	Screw ISO 7049 Ø2,9x9,5	B1000219	4	0,7 Nm
Secure case	Screw ISO 7049 Ø2,9x9,5	B1000219	3	0,7 Nm
	Screw BN82428 Ø4x12	B1000235	2	1,5 Nm
Secure carrying handle	Screw BN82428 Ø3x8	B1000226	1	0,7 Nm
	Screw ISO 7049 Ø2,9x13	B1000220	1	0,7 Nm

Final Assembly:

Stage Description	Component Description	Part No	Qty	Established Process Torque
Secure battery compartment lid	Screw ISO 7049 Ø2,9X9,5	B1000219	4	0,7 Nm
Secure Front Case to Rear case	Screw ISO7049 Ø4X50	B1000237	4	1,5 Nm
	Screw BN82428 Ø4X12	B1000235	2	1,5 Nm

6.5. PART LIST

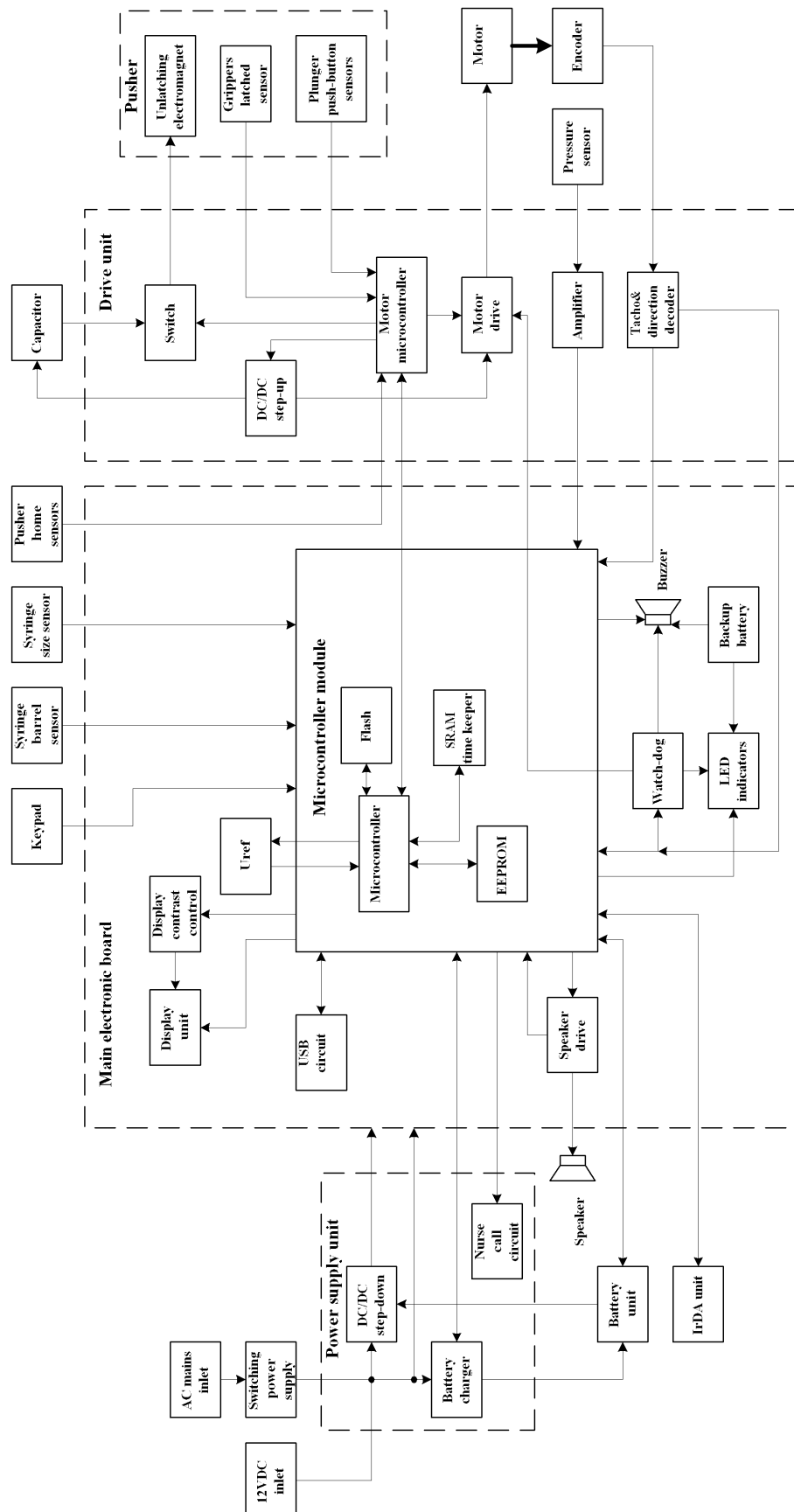
REFERENCE	PART NUMBER	DESCRIPTION	QUANTITY
1	B6660042	Syringe barrel sensor	1
2	B6660044	Encoder unit	1
3	B6660045	Pusher home sensors unit	1
4	B6670009	Motor unit	1
5	V8413101	Motor belt	1
6	B6337024	Drive	1
7	B8126087	Syringe support	1
8	B6678005	Syringe pusher	1
9	B6900003	Drive Unit board	1
10	B6210006	Syringe size sensor	1
11	B8127012	Syringe clamp	1
12	B6300011	Axis	1
13	B8383061	Spring	1
14	B6800003	Display unit	1
15	B3087050-01	Main electronic board (without display unit)	1
16	V6675065	Keypad K1	1
17	B6695001	IrDA unit	1
18	B6340016	Capacitor unit	1
19	B6710010	Speaker unit	1
20	B6680042	USB connector unit	1
21	B6680043	12VDC&Nurse call unit	1
22	B8703045	Cap 12VDC&Nurse call	1
23	B6680044	Mains inlet unit	1
24	B6340014	Power supply unit	1
25	B6340020	Switching power supply	1
26	B6341002	Battery unit	1
27	B8178039	Battery compartment lid	1
28	B8034077	Case	1
29	B6400007	Mounting clamp	1
30	B8126092	Mounting clamp holder	1
31	V5520600	Magnet	1
32	B8917013-01	Silicon gasket	1
33	B8608049	Cap USB	1
34	B8917013-02	Silicon gasket	1
35	B8126088	Extension set retainer	1
36	V6300400	Leg	4
37	B8126094	Holder	1
38	B8383062	Spring	1
39	B8917013-03	Silicon gasket	1
40	V8383027	Spring	2
41	B8250030	Lever	1
42	B8250031	Lever	1
43	B8720026	Carrying handle	1
44	V6300512	Tie WIT-RT-0800	1
45	B8600382	Plate	1

46	B8600369	Plate	1
47	L5555025	Holder	1
48	B8917010	Gasket	1
49	B8917012	Gasket	1
50	B8123030	Cap	1
51	B1000237	Screw ISO 7049 Ø4x50	4
52	B1000235	Screw BN82428 Ø4x12	2
53	B1000219	Screw ISO 7049 Ø2,9x9,5	17
54	B1000220	Screw ISO7049 Ø2,9x13	6
55	B1000112	Screw DIN966 M2,5x10	1
56	B1000235	Screw BN82428 Ø4x12	5
57	B1000225	Screw ISO 7049 Ø3,5x25	1
58	B1000227	Screw BN82428 Ø3x10	1
59	B1000045	Screw ISO 7045 M3x10	4
60	B1000205	Screw BN82428 Ø2,5x12	2
61	B1000226	Screw BN82428 Ø3x8	2
62	B1000203	Screw BN82428 Ø2,5x6	3
63	B1000244	Screw Ø3x35	2
64	B1000043	Screw DIN7985 Ø3x8	1
65	B1000243	Screw BN82428 Ø3,5 l=8	2
66	B1000013	Screw ISO 7045 M3x16	2
67	B1000218	Screw DIN7982 Ø2,9x9,5	2
68	B6100040	Front case	1
69	B6100041	Rear case	1
70	B1001030	Nut ISO 4032 M3	2
71	L5555020	Tie	1
72	V6300508	Spacer SS4-2 d3/6,4x6,4	2
73	B1002091	Washer DIN7349 A3,2/9	8
74	B8917008	Damper	8
75	B8947018	Spacer d3,2/9x1,5	4
76	V6300518	Spacer R908-1 d3,2/4,8x1,6	1
77	V6300521	Washer PD 03-4 d4,3/9x1,4	4
78	B1002220	Washer DIN 6798 A3,2	2
79	B8947043	Washer	3
80	V6300516	Spacer KDR08 d3,6/7x8	2
81	V6300520	Standoff TCEHCBS-4-01	2
82	V6300515	Spacer KDR03 d3,6/7x3	1
83	V6300517	Spacer KDR25 d3,6/7x25	2
84	V6300524	Spacer	3
85	V6300519	Spacer	1
86	B8195006	Push-button	1
87	B8600380	Plate	1
88	B8600371	Plate	1
89	V6060651	Tube (0.03 m)	1
90	B8180271	Label (Serial number)	1
91	B8180285	Label (WARNING)	1
92	B8180286	Label (STANDARD)	1
93	B8180256	Label (Nurse call&12VDC)	1

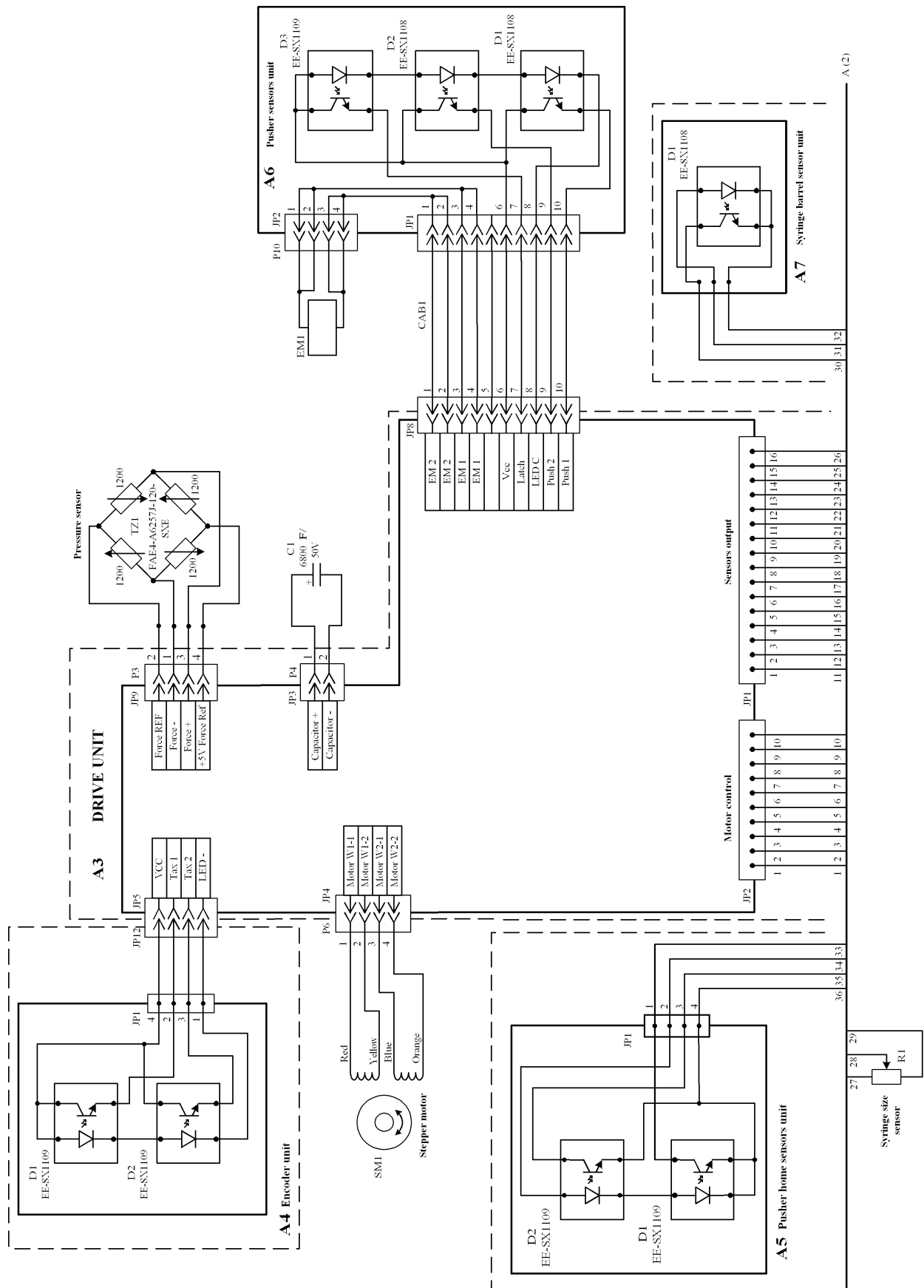
94	V6675063	Label (Speaker)	1
95	B8180255	Label (Instruction)	1
96	B8180257	Label (Extension line)	1
97	V8180082	Label (Electrostatic)	2

7. ELECTRICAL SCHEMATIC DIAGRAMS, COMPONENT LOCATION DIAGRAMS

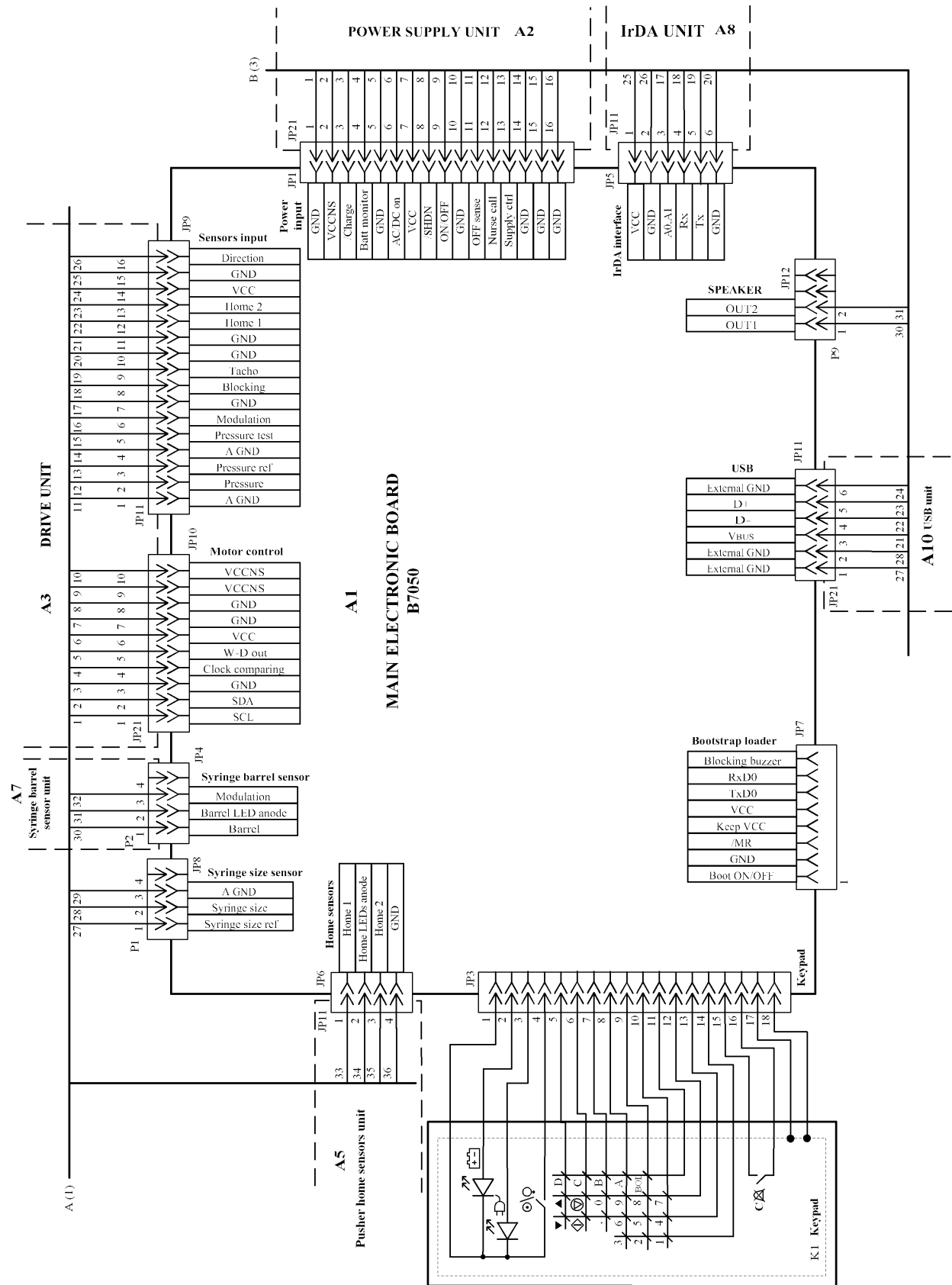
7.1. ELECTRICAL BLOCK DIAGRAM OF THE SYRINGE PUMP



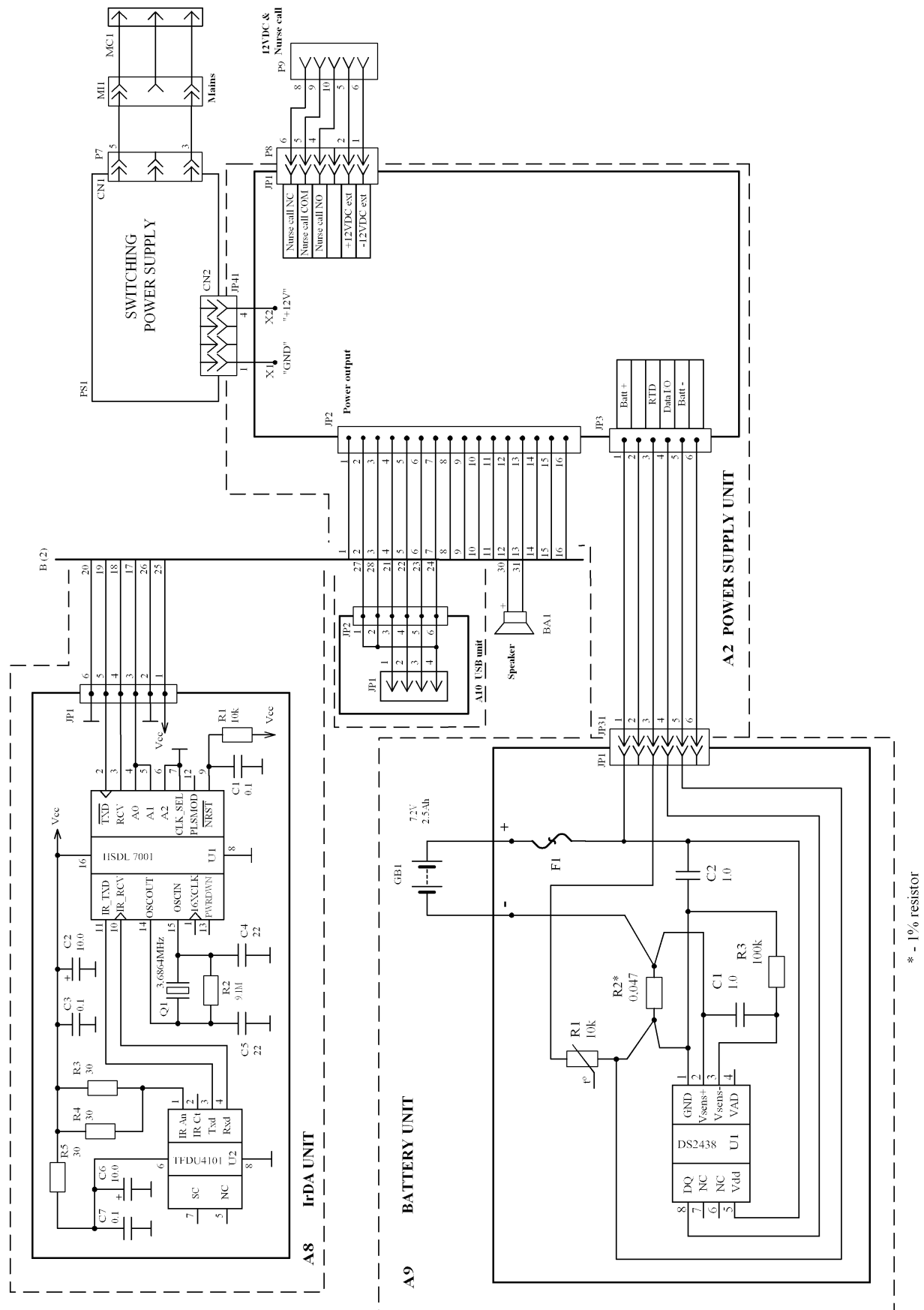
7.2. ELECTRICAL SCHEMATIC DIAGRAM OF THE PUMP



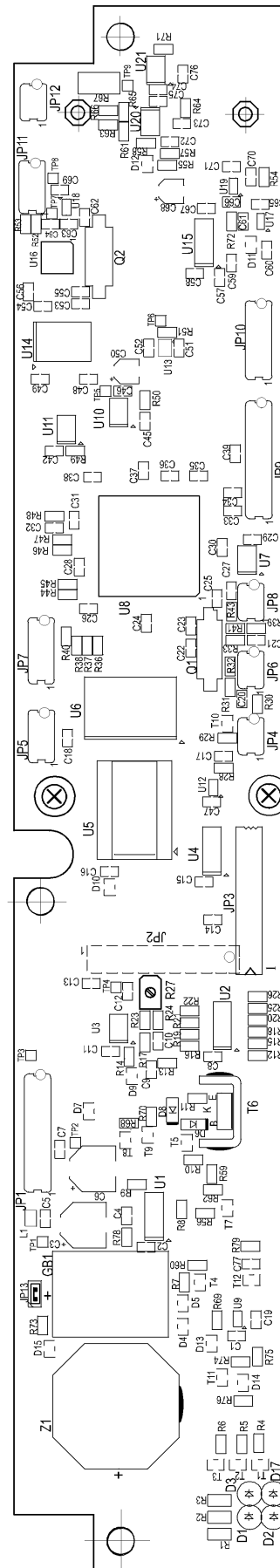
ELECTRICAL SCHEMATIC DIAGRAM OF THE PUMP (CONTINUED)



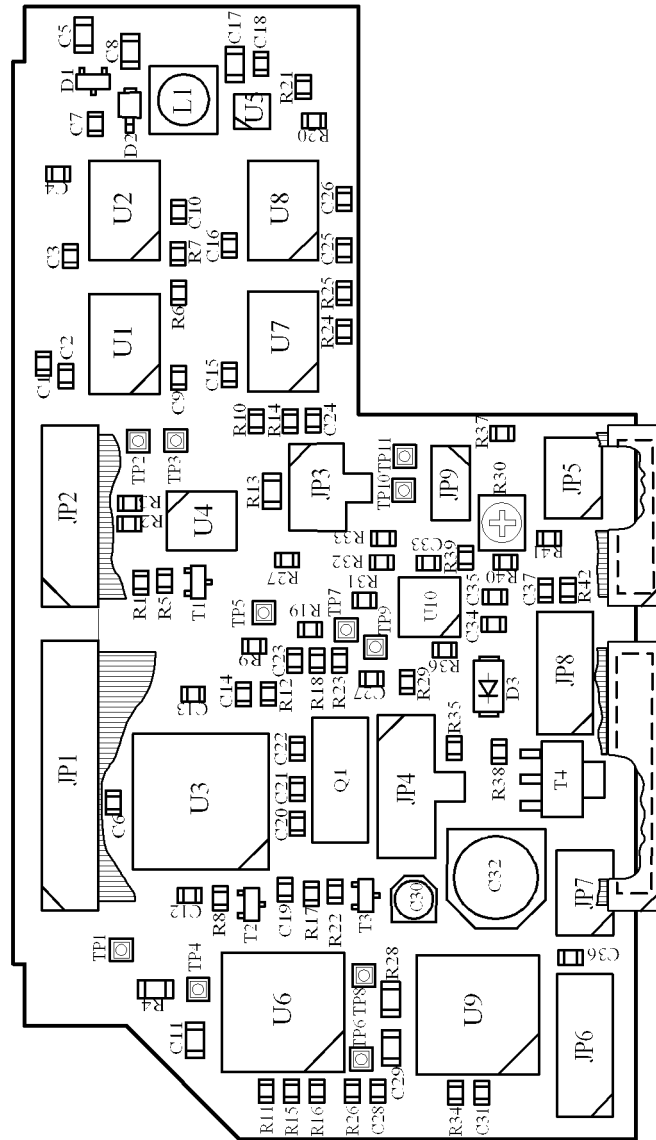
ELECTRICAL SCHEMATIC DIAGRAM OF THE PUMP (CONTINUED)



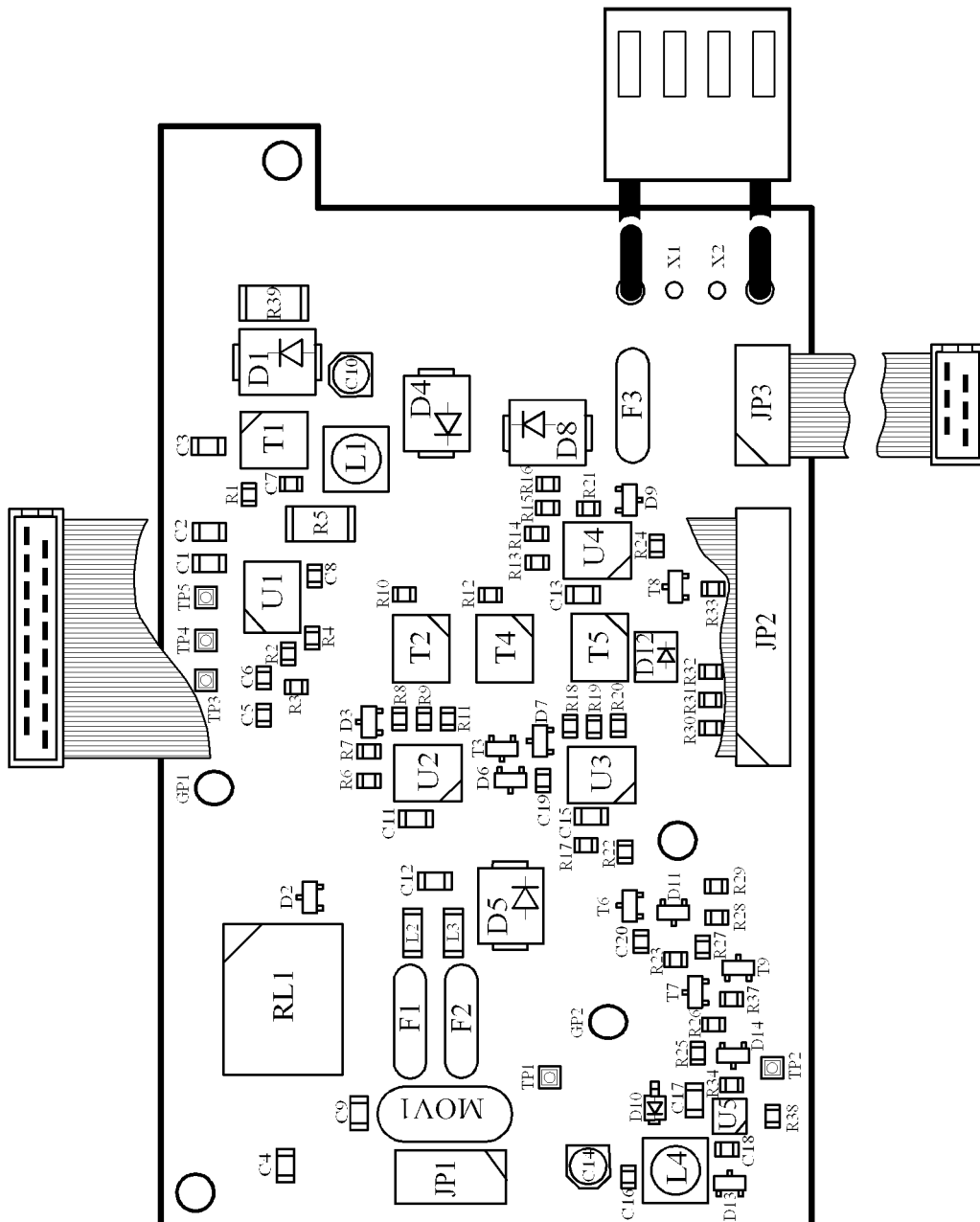
7.3. MAIN ELECTRONIC BOARD COMPONENT LOCATION DIAGRAM



7.4. DRIVE UNIT BOARD COMPONENT LOCATION DIAGRAM



7.5. POWER SUPPLY UNIT COMPONENT LOCATION DIAGRAM



8. SPARE PARTS LISTING

8.1. SPARE ACCESSORIES

PART NUMBER	DESCRIPTION
BB6190050	Set of spacers for calibration
	Digitron pressure meter, model: 2022P (0-1500 mmHg)
P322017	A2016 Firmware Upload Utility
B6690011	Bootstrap Loading Unit

8.2. SPARE LABELS / PUBLICATIONS

PART NUMBER	DESCRIPTION
BS049055EN	Service Manual Aitecs 2016 Syringe Infusion Pump
BN049054XX	Operator's Manual Aitecs 2016 Syringe Infusion Pump
B8180271	Label (Serial number)
B8180285XX	Label (WARNING)
B8180286	Label (STANDARD)
V6675063XX	Label (Speaker)
B8180255XX	Label (Instruction)
B8180257	Label (Extension line)
B8180256	Label (12VDC&Nurse call)

XX- language name codes:

Language name	Code (XX)
English	EN
Lithuanian	LT
Polish	PL
Russian	RU

8.3. SPARE ELECTRICAL COMPONENTS

PART NUMBER	DESCRIPTION
B3087050-01	Main electronic board (without display unit)
B6340014	Power supply unit
B6340016	Capacitor unit
B6341002	Battery unit
B6650034	Nurse call cable
B6650035	12VDC cable
B6660042	Syringe barrel sensor
B6660044	Encoder unit
B6660045	Pusher home sensors unit
B6670009	Motor unit
B6680042	USB connector unit
B6680043	12VDC&Nurse call unit
B6680044	Mains inlet unit
B6695001	IrDA unit
B6710010	Speaker unit
B6800003	Display Unit
B6900003	Drive Unit board
B6340020	Switching power supply
V5570016	AC power lead – European
V5570030	USB A-B cable
V6675065	Keypad K1

8.4. SPARE MECHANICAL COMPONENTS

PART NUMBER	DESCRIPTION
B6678005	Syringe pusher
B6210006	Syringe size sensor
V8413101	Motor belt
B8127012	Syringe clamp
B8126087	Syringe support
B6400007	Mounting clamp
B6337024	Drive
B8608049	Cap USB
B8703045	Cap 12VDC&Nurse call
V6300400	Leg

ANNEX A ROUTINE MAINTENANCE & CHECKOUT PROCEDURE

Model _____ Serial Number _____

Calibration Equipment Used. Record calibration due date and equipment used:	
1.	2.
3.	4.
5.	6.

Test	Pass	Fail
▪ Check AC and battery indicators	<input type="checkbox"/>	<input type="checkbox"/>
▪ General cleaning and inspection for damage	<input type="checkbox"/>	<input type="checkbox"/>
▪ Check the alerts and alarms (According to Operator's Manual, chapter 6)	<input type="checkbox"/>	<input type="checkbox"/>
▪ Date and time are correct.	<input type="checkbox"/>	<input type="checkbox"/>
▪ Perform battery calibration	<input type="checkbox"/>	<input type="checkbox"/>
▪ Perform battery test (10 hours at 5 ml/h)	<input type="checkbox"/>	<input type="checkbox"/>
▪ Check infusion rate accuracy (50 ml/h \pm 1 ml/h) RESULT: _____%	<input type="checkbox"/>	<input type="checkbox"/>
▪ Check occlusion pressure level (L10: 73cmHg-117 cmHg) RESULT: _____cmHg	<input type="checkbox"/>	<input type="checkbox"/>
▪ Check software version. Version Number: _____	<input type="checkbox"/>	<input type="checkbox"/>
▪ Perform drive sensors test	<input type="checkbox"/>	<input type="checkbox"/>
▪ Perform syringe size sensor test	<input type="checkbox"/>	<input type="checkbox"/>
▪ Perform pusher position sensor test	<input type="checkbox"/>	<input type="checkbox"/>
▪ Perform motor test	<input type="checkbox"/>	<input type="checkbox"/>
▪ Perform display test	<input type="checkbox"/>	<input type="checkbox"/>
▪ Perform nurse call test	<input type="checkbox"/>	<input type="checkbox"/>

- | | | |
|--|--------------------------|--------------------------|
| ▪ Perform speaker/buzzer test | <input type="checkbox"/> | <input type="checkbox"/> |
| ▪ Perform keypad test | <input type="checkbox"/> | <input type="checkbox"/> |
| ▪ Perform LED test | <input type="checkbox"/> | <input type="checkbox"/> |
| ▪ Perform watch-dog test | <input type="checkbox"/> | <input type="checkbox"/> |
| ▪ Perform electrical safety test (class II, type CF) | <input type="checkbox"/> | <input type="checkbox"/> |

Comments:

TESTED BY: _____

First Name	Last Name	Signature
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DATE: _____

REVIEWED BY: _____

First Name	Last Name	Signature
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DATE: _____